SCIENTIFIC AMERICAN

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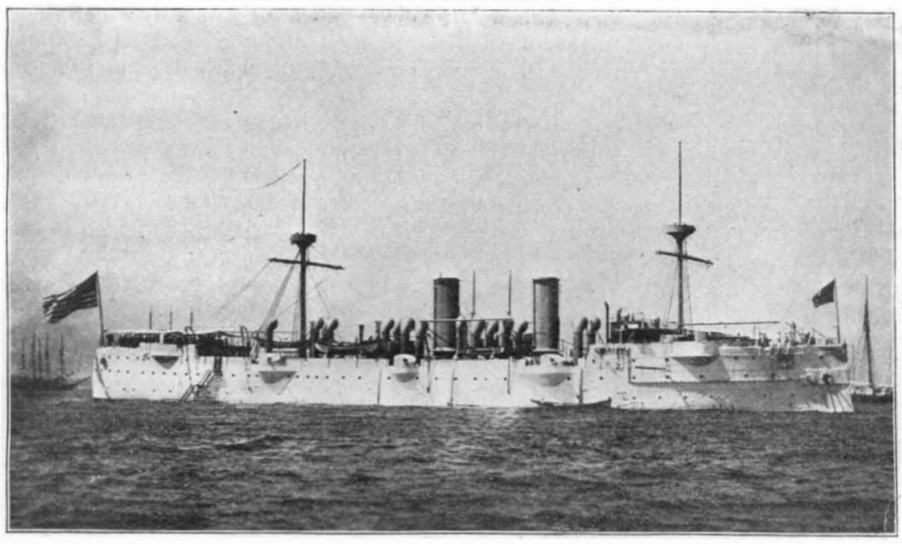
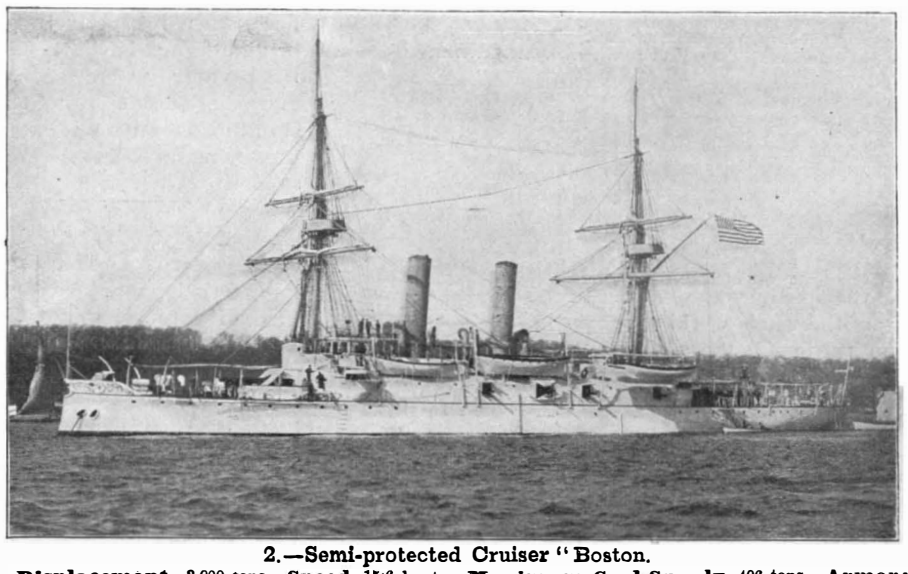


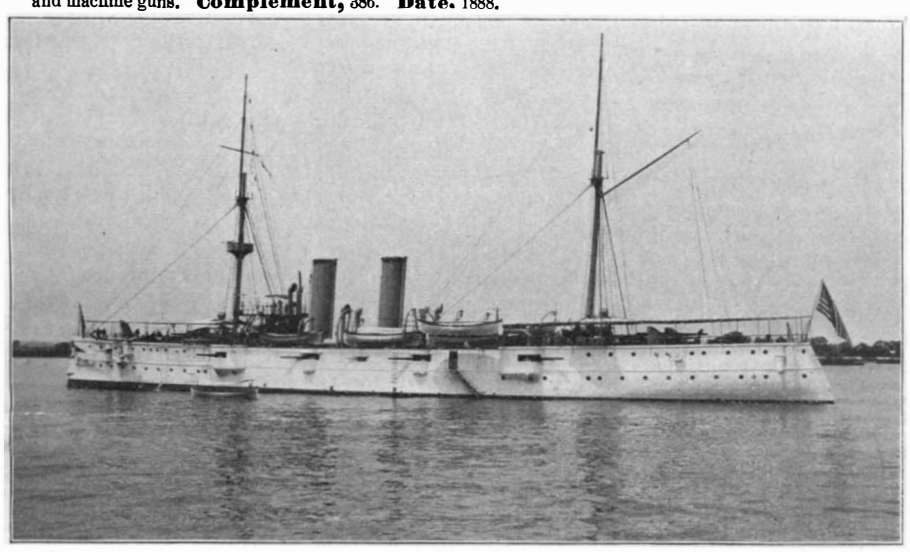
1.—**Protected Cruiser "Baltimore."**

Displacement, 4,413 tons. **Speed,** 20·1 knots. **Maximum Coal Supply,** 1,144 tons. **Armor:** Deck, 2½ inches on flat, 4 inches on slopes. **Guns:** Four 8-inch, six 6-inch B. L. rifles, fifteen 6-pounders and machine guns. **Complement,** 386. **Date,** 1888.



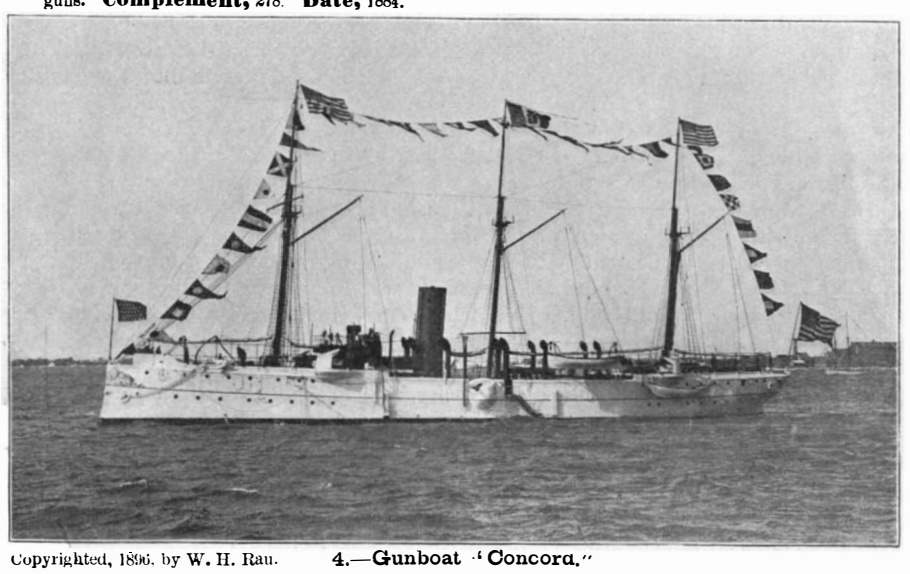
2.—**Semi-protected Cruiser "Boston.**

Displacement, 3,000 tons. **Speed,** 15·6 knots. **Maximum Coal Supply,** 496 tons. **Armor:** 1½-inch deck amidships. **Guns:** Two 8-inch, six 6-inch B. L. rifles, thirteen 6-pounders and machine guns. **Complement,** 278. **Date,** 1884.



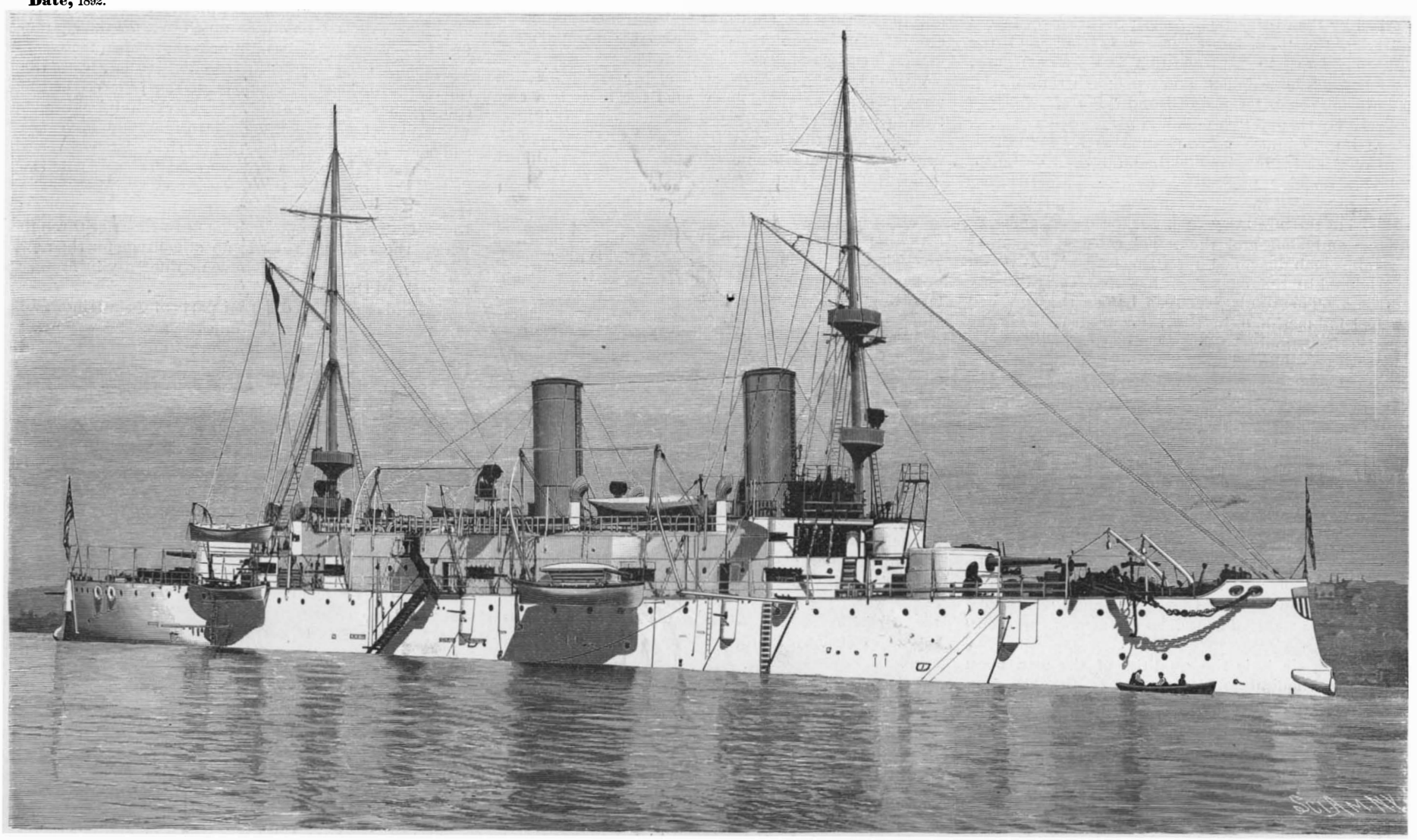
Copyrighted, 1896, by W. H. Rau. 3.—**Protected Cruiser "Raleigh."**

Displacement, 3,213 tons. **Speed,** 19 knots. **Maximum Coal Supply,** 460 tons. **Armor:** Protective deck, 1 inch on flat, 2½ inches on slopes. **Guns:** One 6-inch B. L. rifle, ten 5-inch rapid-fire guns, and thirteen 6-pounders and smaller guns. **Torpedo Tubes,** two. **Complement,** 313. **Date,** 1892.



Copyrighted, 1896, by W. H. Rau. 4.—**Gunboat "Concord."**

Displacement, 1,170 tons. **Speed,** 16·8 knots. **Maximum Coal Supply,** 401 tons. **Guns:** Six 6-inch B. L. rifles, nine 6-pounders and smaller guns. **Complement,** 194. **Date,** 1890.



5.—**Protected Cruiser "Olympia"—Admiral Dewey's Flagship at Manila.**

Displacement, 5,870 tons. **Speed,** 21·7 knots. **Maximum Coal Supply,** 1,170 tons. **Armor:** Turrets, 3½ inches; barbettes and casemates, 4 inches; protective deck, 2 inches on flat, 4¾ inches on slopes. **Guns:** Four 8-inch B. L. rifles, ten 5-inch rapid-fire guns, twenty-four 6-pounders and smaller guns. **Torpedo Tubes,** six. **Complement,** 450. **Date,** 1892.

THE UNITED STATES NAVY—VIII. DEWEY'S FLEET AT MANILA.—[See page 216.]

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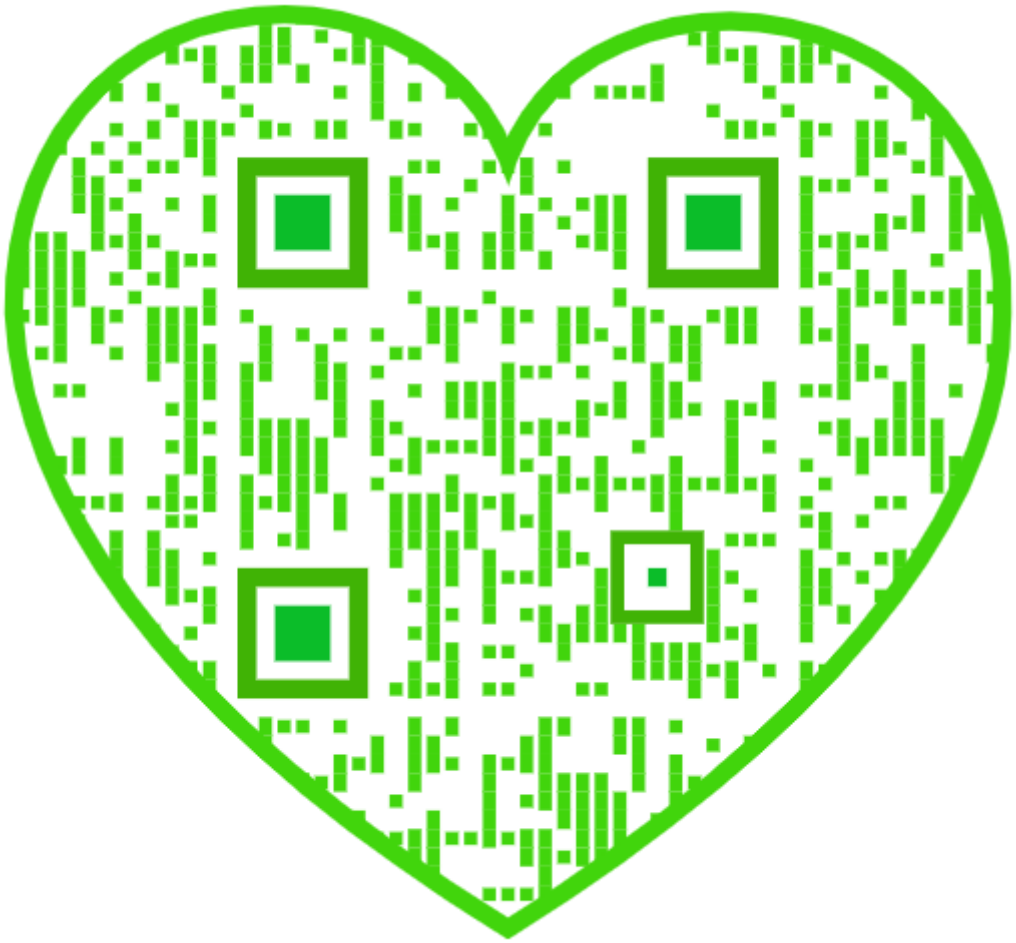

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NEW YORK, SATURDAY, SEPTEMBER 30, 1899.

THE ARMS AND THE MAN.

In the opening days of the Spanish war, when the eyes of the whole world were bent with close attention upon the combatants, there were two questions in every one's mind, the answers to which were awaited with no little interest: Would the ships of the new navy of the United States, excellent as they appeared upon paper, stand the searching test of a sea fight, and would the officers and men, regarding whose tactical skill or amenity to discipline doubts were freely entertained abroad, prove equal to the exacting requirements of modern naval warfare?

The answer came earlier than it was expected and from a far-away and totally unlooked-for quarter. On that eventful morning of May the first, eighteen hundred and ninety-eight, the fortunes of war gave to Admiral Dewey the opportunity to declare that in the quality of its ships, in the daring and well considered enterprise of its officers, and in the deadly skill of its gunners, the United States had not fallen away from the splendid traditions of the past.

In discussing the arms and the man, it would be a gross injustice to that branch of the naval service whose field of operation is confined to the draughting-board and the proving ground if we failed to do justice to the excellence of the little fleet which carried Dewey through the famous battle of Manila Bay. In every case the ships from keel to truck were the product of our own ship-yards and gun factories, and in the flagship "Olympia" was represented one of the most successful vessels ever designed for our own or any other navy. With her powerful and well protected batteries, the high freeboard, and unusual speed, she embodied the characteristic features which have marked the later cruiser designs of our construction department. The other fighting ships of the fleet, though of an earlier date, and, therefore, not possessing such all-round excellence as the "Olympia," were marked by the distinctively American feature of heavy batteries, the "Baltimore" carrying four and the "Boston" two 8-inch, in addition to six 6 inch guns, the "Raleigh" one 6-inch and ten 5-inch rapid-firers, and the gunboats "Concord" and "Petrel" carrying respectively six and four 6-inch guns.

The hulls, engines, guns, mounts and ammunition were of American make, and had all been designed, built, and set afloat practically within the past ten years. Never, since 1883, when we began to build, had the material of the new navy been put to the test, and only the line and staff and the naval constructors knew just how much depended upon the verdict that would be rendered by the engagement of that early Sunday morning. The result was seen before the sun had reached its meridian, in the utter destruction of the Spanish fleet, and the silencing of the fortifications under whose shelter it fought, at the cost of practically no injury whatever to the American ships.

It is no reply to this to say that the enemy's ships were altogether inferior. Mere negative qualities in Montojo's fleet may have increased, but they did not cause the disaster. It was the positive excellence of our engines, the accuracy of our guns, the reliable quality of our shells, that rendered certain (other things being equal) the victory of Dewey's fleet over the combined sea and land forces of the enemy; and no ungenerous attempts to minimize the obstacles to be overcome can affect the significance of the results. The sunken ships and silenced forts of Manila Bay were a tribute to the material as well as the men of the American navy.

But, after all, it is the qualities of the man upon which the thought and sentiment of the American people are fixed in this hour of celebration. And in honoring Dewey by the present overwhelming outburst of enthusiasm, there is in the minds of the American people no intention to exalt the heroes of the far-away Pacific at the expense of those who won the decisive victories by sea and land at Santiago. The destruction of Montojo's fleet at the opening of the war was not one whit more complete than the annihilation of Cervera's squadron at its close—the blockade of Manila has its counterpart in the impenetrable cordon which was drawn around Havana and Santiago; and the heroism of that midnight dash into the supposedly mine-strewn channels off Cavité found a worthy echo in the trip of the "Texas" through the mine fields of Guantanamo Bay and the matchless self-sacrifice of the "Merrimac."

In passing in procession down the long line of triumphal march, Dewey and the men of the "Olympia" represent all that is best and bravest in the American navy. Every great war has produced its popular hero, and in its desire to select some one man to play worthily the role of returning conqueror, the nation has turned instinctively to the gallant sailor whose brilliant campaign in the far-away Southern seas struck the keynote of victory at the very opening of the war, and whose masterly diplomatic control of the difficult situation created by that victory has marked him as possessing at once the qualities of statesman and soldier.

THE NATIONAL EXPORT EXPOSITION.

Wherever American manufactured products are known their excellence is recognized. The genius and ingenuity of mechanics trained in the workshops of the United States, where there is every incentive to the exercise of the inventive faculty, have produced machinery which has attained a world-wide celebrity and in many cases is the best obtainable. Likewise the finished products of various industries of the United States have obtained for themselves a commanding place in the world's markets. Our supremacy is shown in a very practical manner by our magnificent trade balance, which is proportionately increasing month by month. It is singularly appropriate that our entrance into foreign trade upon a large scale should be marked by some form of commemoration in this, the closing year of the century. The National Export Exposition at Philadelphia, which opened its doors September 14, is the first exhibition of its kind ever held in this or any other country, and is organized on broad and liberal principles, the object being to aid the American manufacturer to exhibit his products and to show him for comparison what is manufactured in other countries in the same line, together with the details of quality, quantity, and price, thus enabling him to study the markets of the world by viewing the collections gathered under one roof. Ample appropriations by Congress, the city of Philadelphia and the State of Pennsylvania, supplemented by generous contributions of the citizens of Philadelphia, provided money sufficient to carry out the plans of the projectors of the Exposition on a liberal scale.

The scheme of holding a national exposition of the manufactures of the United States specially suited for export was thought of by the officers of the Philadelphia Commercial Museum, and was first discussed publicly by a number of prominent citizens of Philadelphia in October, 1897. The ground was broken for the main building the last week of March of this year, and in less than six months handsome and commodious structures were reared, and every arrangement made for the opening of the Exposition.

Philadelphia is, perhaps, as good a location for such an exposition as could be wished for, as it is a city turning out over $600,000,000 worth of manufactured products annually, and it is the seat of the Philadelphia Commercial Museum, which is in itself a unique enterprise. By this Exposition the country virtually challenges the world to produce articles as good and as cheap as those here exhibited, which vary from articles as small as a spool of thread to the largest locomotive. Our supply of raw material is unequaled, and our factories are splendidly equipped for manufacturing. The genius and activity of American engineers in designing and constructing these plants have been the wonder of foreign experts, and American workmen have wisely never opposed the introduction of modern methods or labor-saving devices as they do abroad. Their characteristic energy, adaptability, and ingenuity, have advanced American manufactures and made it possible for us to export many lines of goods which, a few years ago, would have been considered to be out of the question. The workmen are better paid, better fed and clothed, and live better in every respect than their foreign brothers, and at the same time we are enabled for the aforesaid reasons to produce goods which, owing to their quality and price, sell without difficulty in the markets of the entire world. These facts are amply demonstrated by the Exposition, which, it is hoped, will begin a new era in the extension of American trade in foreign countries.

Other nations are constantly making plans to secure markets outside of their own dominions. While France, Belgium and Germany established schools in which to educate their active men for commercial supremacy, and while Great Britain and other Continental countries have opened bureaus for the systematic study of commerce and its relations to their manufacturing interests in foreign fields, the United States remained almost alone as the only country which took no steps to market her products outside her own dominion. Recently, however, the excellence of our goods became recognized abroad, and the result has been a constantly increasing demand. The manufacturer found himself confronted by foreign trade requirements of which he knew but little, and it has been the pleasant duty of the Philadelphia Commercial Museum and our consuls to inform them as to these requirements, and to-day we have commercial experts all over the world, who are sending home reports for the benefit of our own manufacturers.

To supplement and complete this well-studied system for the introduction of American manufactures in foreign markets, it was necessary to take one further step; this was the development of a plan by which the buyers of American products in foreign countries could see for themselves our admirable methods of manufacture, the skill which we employ in making our goods and the superior materials which enter therein. To carry out this part of the work, the National Export Exposition was organized as it stands to-day, and now the foreign buyer can see a large and diversified exhibit of American wares, and it is gratifying to note that the governments of the whole world have been invited and a large number of delegates have been detailed to visit the Exposition and report upon it. Thus, the producer and the buyer from the four quarters of the globe will be brought together in close contact. It is not an international exposition but is intended solely to foster American trade. With this limitation the Exposition will admirably fulfill its purpose.

THE EUPHRATES VALLEY RAILROAD.

It is said that an English syndicate has secured the concession from the Sultan of Turkey to build a railroad through the Euphrates Valley to the Persian Gulf. If the scheme materializes, the railroad will run through the reputed site of the Garden of Eden. Biblical scholars have reasoned that this tract was in Mesopotamia, the district lying between the rivers Tigris and Euphrates, and if this is the case the railroad will traverse it. The project of building a railroad from Constantinople to the Persian Gulf was broached many years ago by the late Ferdinand de Lesseps, but his attempts were in vain. England and Russia have both tried to obtain a similar privilege. At last Germany received permission to build a railroad from a port opposite Constantinople to Angora, and the Anatolian Railroad was the result. The extension of this railroad from Koniah, first to Bagdad and thence to Bassora on the Persian Gulf, has been a pet scheme of Emperor William, and according to The New York Herald, the move which the English syndicate is now about to undertake is a result of the entente cordiale between the two countries.

To Great Britain it means a new and shorter road to India, as five days may be saved, and to Germany it means a new field for colonization and a good feeder for a road already in operation. The first year the Anatolian Railway carried three hundred carloads of wheat, the second year seven hundred carloads of cereals. The railroad has done much to alter the character of the country, to build up towns, to open factories, and bring good European colonists to cultivate the soil. One of the chief obstacles to the progress of the country has been the shiftless Turkish inhabitants, who did not wish to use modern tools and have not sufficient ambition to try to get rich. They will not sit in the seats in the railway cars, but squat on the floor, so that at last it was necessary to take out the seats and leave the passenger coaches almost like cattle cars. The sparse population of the district through which the railroad runs is an advantage for the new comers from Europe, who have no difficulty in finding all the land they require.

The climate of the different parts of Asia Minor and Mesopotamia is so varied that the greatest variety of products can be raised successfully in different parts of this broad domain.

THE MAUSER PISTOL.

Dr. J. D. Griffith, of Kansas City, has just completed for the government an official test of the Mauser pistol in use by the German calvary, and it is under consideration for adoption by the United States. The test was made with targets and human bodies, and the results were most satisfactory. At ranges from 50 to 500 yards the Mauser pistol is the most effective and deadly weapon of its kind ever invented, and up to the maximum range tried it is practically as good in the hands of a marksman as a Krag-Jorgensen, a Lee or a Mauser rifle. If nothing but flesh resists the passage of the bullet, it makes a round incision where it enters and a knife-like cut where it departs. Should a bone be in the way it is often shattered into fragments. The pistol shoots very accurately and will kill at a range of 500 yards. The bullets pass through a human body at that range. If the bullet should enter a vital organ, it would undoubtedly kill a man instantly, and would incapacitate a soldier if it struck a bone. The pistol fires ten shots without reloading, and can be emptied in less than three minutes. The bullets weigh 85 grains and have a lead core surrounded by a nickel-plated copper jacket.

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THE HEAVENS IN OCTOBER.

BY GARRETT P. SERVISS.

The increasing crispness of the air in the middle of autumn imparts a livelier sparkle to the stars. But at this season of the year the greatest of the constellations are absent from the evening sky, although their coming for the winter carnival of celestial wonders is already heralded by signs well known to the habitual stargazer. For the contemplative observer, who knows the order of the procession of the Zodiac, the southern and eastern heavens in an October night wear an aspect of preparation, an expectant and prophetic air, as if the curtain of the sky had been dropped in readiness and rose again when the vast and sublime spectacle hidden behind it is ready for exhibition.

While the northeastern quarter and the region overhead are bright with Andromeda and Cassiopeia, Perseus and Cygnus, and the sheen of the Milky Way attracts the eye west of the meridian, the south is occupied by the broad and scattered constellation of Aquarius, high above which the four chief stars of Pegasus, like golden corner marks, stake out a huge square of gloomy sky near the zenith. Low in the south at the same hour of the evening, say 9 or 10 o'clock, hangs a single sparkler of nearly the first magnitude, the lone Fomalhaut, which the Southern Fish carries like a flaming jewel in his distended mouth. Eastward the gloom deepens.

But the experienced lover of the stars will not be content with this early evening view. He will look out again at midnight, when Cetus will be upon the meridian, with Aries overhead, while in the east the curtain has been withdrawn, the spectacle is in full swing, and the head of the celestial armies, with the Pleiades glittering like an oriflamme high in advance, comes marching up the sky. Orion and his matchless cortege are on their way, foretelling the splendors of their winter reign. At the same moment when Sirius, the winter's prince of stars, is rising, Vega, the glory of the summer heavens, is setting, and thus the autumn sky, like the autumn landscape, is at the same time full of reminiscence and of expectation.

THE PLANETS.

The constellation of Libra, a somewhat featureless province in the geography of the heavens, will, during October, shine with borrowed and unusual splendor. It will be the scene of the assembling of four of the great planets, Jupiter the mightiest of all, Venus the most beautiful, Mars the enigmatical, and Mercury the eccentric. Jupiter is within the borders of Libra at the beginning of the month; the other three will arrive upon the field, coming from the west, before its close. All of the planets named, together with Saturn and Uranus, which lie further east, and Neptune, which is in Taurus and rises before midnight, are evening stars. In fact, there is no planet left to play the role of morning star in October. Every one of the earth's sister planets, no account being taken of the tiny asteroids, is in the competition for evening honors, while the pale dawn must brighten as it can alone. Unfortunately, however, this galaxy of evening stars will fail to create a furor among the admiring inhabitants of the earth, because, with the exception of Saturn, they are either so faint or so near the sun that only the initiated will be able to recognize them.

October will also witness the beginning of a remarkable series of planetary conjunctions, culminating in November, and continuing through December. Six of the seven large planets besides the earth will be assembled in one quarter of the sky, in or near the zodiacal sign Scorpio, which I believe is of ill repute among astrologers. Some effects, interesting to mathematicians, in the great balance of forces that constitutes the stability of the solar system, are produced when nearly all the larger members of the sun's family of worlds have gathered on one side of the domestic circle, but all predictions of evil to the earth, or its inhabitants, proceedingfrom planetary conjunctions are, of course, based only on imagination or superstition.

Stated in detail, the planetary phenomena during October are as follows: Mercury is an evening star, passing from Virgo into Libra. It is so near the sun that it will not be easily visible until November. It is in conjunction with Venus on the 10th at 6 A. M., when the apparent distance apart of the two planets, if they could be seen, would be only three-quarters of a degree. On the 25th Mercury will be in conjunction with Jupiter just before midnight. On the 23d Mercury reaches its greatest distance from the sun, which, in the case of a planet having so eccentric an orbit, and so short a period, must mean a fearful drop of temperature as compared with the heat endured only six weeks before.

Venus is an evening star, moving from Virgo into Libra, but, although slowly receding from the sun, it is too near the solar orb and too far from the earth to be well seen. It will brighten during the winter and attain its greatest brilliancy next May, within three days after the total solar eclipse, to which astronomers everywhere are now looking forward. It is in conjunction with the star Alpha Libræ at 1 o'clock P. M., on October 26, at which time an apparent space of only six minutes of arc will separate the star from the planet. On the 29th, at 8 P. M., Venus and Jupiter pass one another within a distance about equal to the apparent breadth of the full moon.

Mars is an evening star, moving from Virgo into Libra. Like the others, it is too near the sun for observation. It is in conjunction with Jupiter at noon on the 11th.

Jupiter is an evening star in Libra, and can easily be seen in the twilight at the beginning of the month, but it rapidly loses its brilliancy, as it is apparently swallowed up in the solar rays. It plays the greatest part in the planetary conjunctions of the month, meeting Mars on the 11th, Mercury on the 25th, and Venus on the 29th.

Saturn is an evening star in Ophiuchus, and is the only planet that can be well seen in October. It appears in the southwest in the early evening, and its rings continue to present an admirable telescopic spectacle.

Uranus in Ophiuchus and Neptune in Taurus are too faint to be interesting, except for the working astromomer.

THE MOON.

New moon occurs on the afternoon of the 4th, first quarter on the morning of the 12th, full moon on the afternoon of the 18th, and last quarter on the morning of the 26th. The moon is nearest the earth on the morning of the 16th, and at the greatest distance about midnight on the 27th. The lunar conjunctions with the planets occur as follows: Mercury, the 5th; Venus, the 5th; Mars, the 7th; Jupiter, the 7th; Uranus, the 8th; Saturn, the 9th; Neptune, the 23d.

ELECTRIC LIGHTING AT THE COVENT GARDEN THEATER.

The new lighting plant of the Covent Garden Theater, London, presents many points of interest. It should be said, while called a "theater," it is really a great opera house in which masterpieces can be effectively staged. The old gaslight has now been entirely done away with, and a complicated system of electric lighting has been substituted, adding greatly to the efficiency of the stage setting.

In the stage lighting several novel features were introduced, the first being the provision for four colors, white, red, blue, and orange, for obtaining stage effects. This is probably the first time that orange-colored lamps have been used for stage work in England, the effects being previously obtained by burning white lamps at very low candle power. Of course, good effects may be obtained in this way, but the method is extremely wasteful. The switch gear is placed below the stage in a fireproof room, from which the electrician can obtain a full view of the scenes as lighted.

According to The English Electrical Engineer, from which we glean our facts, there are seven battens, six of which are 61 feet long and one 40 feet long, which is used to light the back drop or the back wall. Each batten carries 220 lamps of 16 candle power, divided in colors as follows: 80 white, 40 amber, 50 red, and 50 blue. For these battens no less than twenty-eight regulators with liquid resistance are provided, so that the illumination can be easily varied and changed in color without causing any flickering. There is one regulator for each color in each of the battens, so that they can be varied independently. Arrangements are provided by which the cables which supply the battens can be discontinued in case they have to be removed. The battens have a rise and fall of 12 feet; in each of them four pilot lamps are installed, which can be controlled from a special switch on the stage switchboard. They are used to give sufficient light to the stage hands without having an electrician operating the main switchboard.

The large battens weigh practically 16 cwt., and are suspended by six ½-inch steel ropes, an insulated support being placed between these ropes and the bridle chains to the battens.

There are five wing lights on each side of the stage. The framework of the reflecting part is much the same as that of the battens, each being supported by lattice steel work and provided with an oak filling to carry the cables. In each of these wing lights there are seventy-five 16 candle power lights, of which thirty are white and fifteen are colored respectively amber, blue, and red. The wing lights are supported on ladders which run on wheels on the mezzanine floor. By this means the wings have a travel of 16 feet; that is, 8 feet each way from their normal position. There are iron boxes and switches for the wing lights at the bottom of each. The proscenium lights, which are placed just inside the frame of the stage, each contain 50 white lights, 30 blue, 30 red, and 25 amber. They are similar in construction to the wing lights. In addition to the fixed lights, two circuits are run around the stage and are connected with plugs in various parts, from which portable lights can be applied to light ground-rows, transparencies, etc. Feed wires are run in canvas hose, which, by flattening out on the stage, is the least liable to cause accidents. The heavy scenery can be run over such hose without damaging the cables.

The switch-room, which is placed below the stage at one side, is built up of iron plates. Access to it is obtained by means of an iron door in the mezzanine floor, from an iron door in the orchestra, and by means of a trap-door and ladder from the stage. The main receiving switchboard and fuseboards are placed two floors below. The liquid resistance which is used is the most interesting point, and switches control the lights in the usual way. Iron wheels control one color or as many of the circuits of that color as may be required. Each regulating switch or "dimmer" works around the main axle, which is operated by means of a bicycle chain, which raises or lowers the cone in the liquid resistance cans in the cellar. When the lever is right home it short-circuits two contacts, which cut out the liquid resistance entirely. The resistance room is fireproof. The insulated cables are attached to terminals on the copper rods coming from the lead cones. The liquid used in the jars is zinc chloride.

In addition to the stage lighting, all dressing rooms, passages, and corridors, the "gridiron" and the "cellars" around and beneath the stage have been provided with electric lights. Wingfield Bowles, Esq., was the consulting engineer.

AN IMPROVEMENT IN THE MANUFACTURE OF ARSENATE OF LEAD.*

In a paper read before this Association at its meeting in August, 1897, the writer referred to a method of producing arsenate of lead by using nitrate of lead as a source of soluble lead. According to our chemist, Mr. F. J. Smith, arsenate of lead formed by this process is the diplumbic, or more exactly, a mixture of about one part triplumbic and two parts diplumbic, and not the triplumbic entirely, as is produced where arsenate of soda is neutralized with acetate of lead, as in the ordinary process of manufacture. Arsenate of lead made from the nitrate contains a slightly increased percentage of arsenic (about five per cent); and as the nitrate of lead may be purchased at a less cost than the acetate, the saving made where several tons are to be prepared is quite an item.

At the time when the diplumbic arsenate was first brought to the attention of this Association only a few experiments had been carried on. Since that date the insecticide has been tested in an extensive series of laboratory and field experiments, and in 1898 and again the present year by actual spraying operations in the field. A part of the results of the experiments have been published in the report of the gypsy moth committee, January, 1898, and without presenting the mass of details, from the numerous tests we may state in brief that in every case the arsenate of lead made from the nitrate has proved itself equal if not superior to that prepared from the acetate.

In preparing arsenate of lead by either process it has been found most economical to use a high grade of arsenate of soda, as the impurities, such as salt, in the lower grades neutralize a considerable part of the soluble lead before the reaction with the arsenate of soda can commence. The gypsy moth committee obtained from an English firm an arsenate of soda that showed on analysis 67·5 per cent of arsenic. This material costs when delivered, $0.052 per pound. To make one ton of arsenate of lead there are required 888 pounds of this arsenate of soda at a cost of $46.18, and 2,398 pounds nitrate of lead at a cost of $161.87, the total cost being $208.05. With the same grade of arsenate of soda, but using acetate of lead, there are required for one ton of arsenate of lead, 758 pounds arsenate of soda costing $39.42, and 2,593·8 pounds acetate of lead costing $207.50, a total cost for ingredients of $246.92. This leaves a balance of $38.87 per ton in favor of the arsenate of lead made from the nitrate.

Where the proportionate amounts of arsenate of soda and acetate of lead are tied in a package as in the ordinary procedure, the dampness of the acetate of lead will set up a partial reaction, and thus a part of the value of the insecticide is lost. When nitrate of lead is used, there is but little of this partial reaction.

ARRIVAL OF SIGNOR MARCONI.

Signor Marconi arrived on the "Aurania," September 21. As we have already stated, he is to assist in reporting the races for the America's cup. He was accompanied by Messrs. Rickard, Bradfield, and Denshan, skilled operators who have been engaged with experiments on wireless telegraphy across the English Channel and who will be in charge of the instruments and send the messages to The Herald during the yacht races. Signor Marconi began his experiments in 1895, when he tried to establish communication between various parts of his father's estate near Bologna, Italy. In 1896 he arrived in England, and after working in conjunction with Mr. W. H. Preece, then chief electrician of the British post office, he gave a demonstration of the possibilities of the system during the volunteer evolutions on Salisbury Plain and also in the British Channel.

*A paper by A. H. Kirkland, of Malden, Mass., Assistant Entomologist of the Massachusetts State Board of Agriculture. Read August 19, 1899, at the Ohio State University, Columbus, O., before the Association of Economic Entomologists, an affiliation of the American Association for the Advancement of Science. Revised by the author.

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THE NATIONAL EXPORT EXPOSITION, PHILADELPHIA.

The grounds of the National Export Exposition, which was formally opened September 14, 1899, are admirably situated on the west bank of the Schuylkill River, within ten minutes' ride of Philadelphia's great city hall. There are not less than sixty-two acres in the inclosure, fifty-six being deeded to the Philadelphia Museum by the city and another tract of six acres being secured for the use of the Exposition.

The main group of buildings is so arranged as to form one imposing structure 1,000 feet long and 400 feet wide, and covers an area of more than nine acres. Five separate buildings really enter into this large edifice. Three of these structures are to be permanent; these are the north, center, and south pavilions, which are each 380 feet long and 90 feet wide The spaces between them are covered by temporary buildings connected with the permanent pavilions, the whole forming a single harmonious edifice. The permanent buildings will eventually become the home of the Philadelphia Museum. The temporary building between the north and center buildings is 300 by 297 feet; it comprises an auditorium and music hall 200 feet long and 140 feet wide seating 6,000 persons, with arcades for exhibits on each side 300 feet long by 78 feet wide. Between the central and southern wings there is an immense exhibition hall 383 by 297 feet. The exhibition spaces on the first floor of the wings open into the main hall with side arcades, so that the entire area of 167,200 square feet is practically a single open space. While the Exposition is of an eminently practical nature, the artistic side has not been lost sight of; on the contrary, the ornamentation and decoration of the structure, though of a temporary character which must of necessity be used in all exposition buildings, will delight the eye and will recall the "White City" of 1893. The buildings are covered with a peculiar composition, the basis of which is plaster and papier mache, which is more durable than the staff which was used at Chicago. The pavilions naturally received the greatest attention and they are admirable from an architectural point of view, as will be seen by our engravings.

Above the main entrance a large pediment contains a group of thirteen figures representing "Commerce;" other pediments typify the four continents. Numerous groups of graceful figures symbolical of "Transportation," "Navigation," "Labor," "Electricity," etc., rest on pedestals Beside the pediments and over the main entrance there is a large quadriga drawn by four horses carrying a figure of "Progress." Around the roof runs an iron balustrade of rich design, and from the numerous flagstaffs float the flags of all the nations which were represented in the International Commercial Congress. The main building was designed by Wilson Brothers & Company, assisted for the permanent part by G. W. & W. D. Hewitt, Philadelphia, architects.

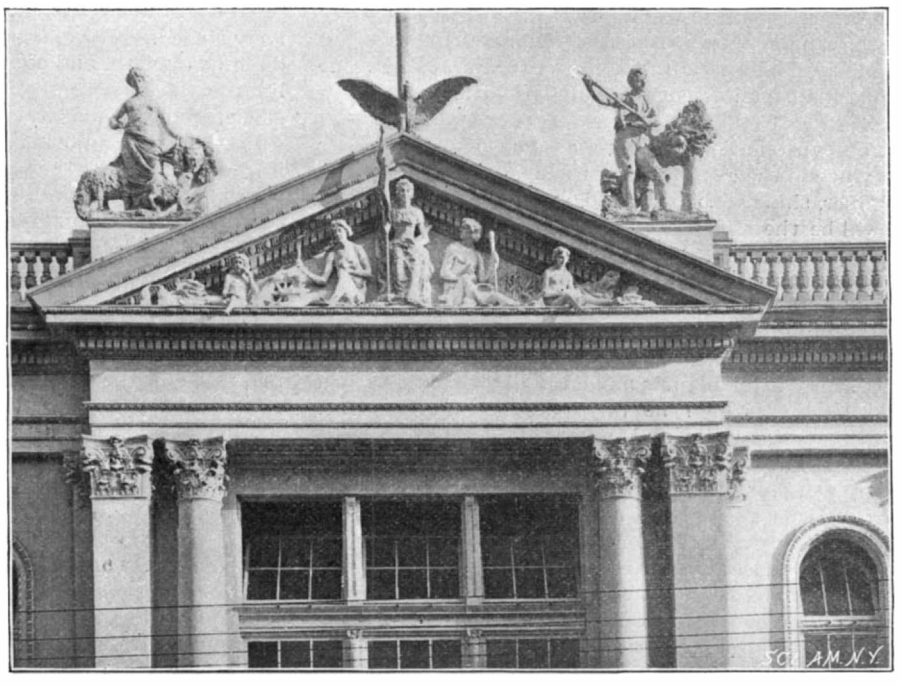
The main building is reached from the main entrance by an esplanade, where the visitors will find numerous attractions which it is deemed necessary to have in all expositions. It is very suggestive of the "Midway" at the Chicago Exposition. To the south of the main building is an Implement, Vehicle, and Furniture Building measuring 450 by 160 feet, and next to this is an open shed termed the Transportation Building. It is 450 feet long and 75 feet wide, and is provided with two tracks, so that it is available for the exhibit of rolling stock. The building offers every advantage for the handling and disposition of these heavy products, and representative displays are made by the Baldwin Locomotive Works, Pullman Company, and other manufacturers.

Unfortunately at the present time the space of many exhibitors still remains vacant, but exhibits are being rapidly installed, and in the course of a week or so the Exposition will be complete. The exhibits are numerous and include most of the best known manufactures in America. The booths are fitted up so as to present an attractive appearance. The Pencoyd Works, builders of the Atbara bridge, easily carry off the honors by a splendid exhibit of their work. There is a great lack of novelties, but after all it must be remembered that this is in no sense an international exposition, and it fulfills admirably the purpose for which it is established.

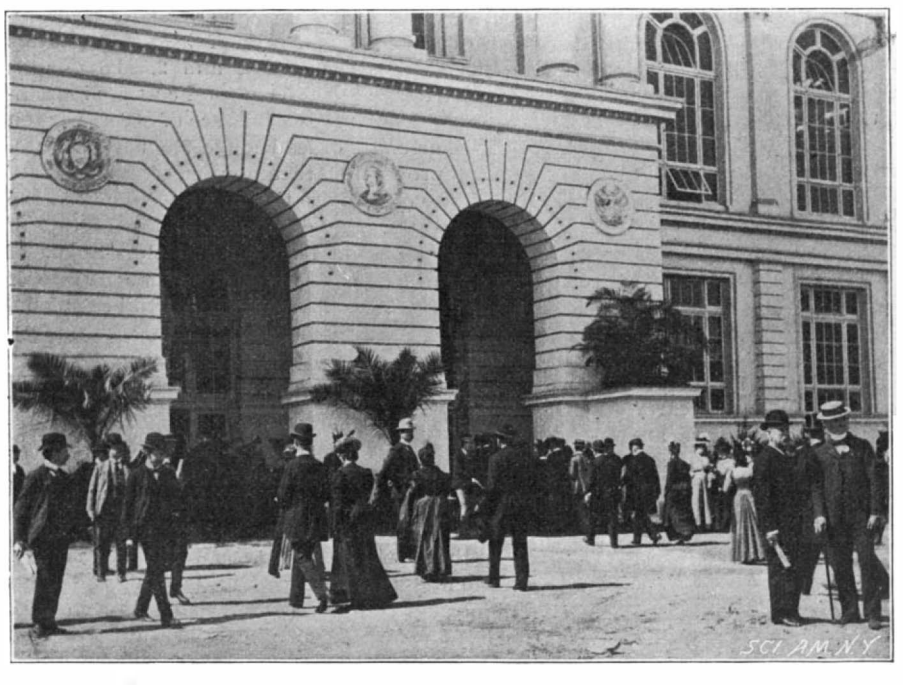
Of special importance is the exhibition of foreign trade samples collected by special commissioners of the Philadelphia Commercial Museum. These are displayed on the second floor of the center pavilion. These agents visited all the important markets of the

THE NATIONAL EXPORT EXPOSITION AT PHILADELPHIA.

GROUPS OVER MAIN ENTRANCE.



PEDIMENT OF PAVILION.



MAIN ENTRANCE.

VIEW OF THE ESPLANADE.

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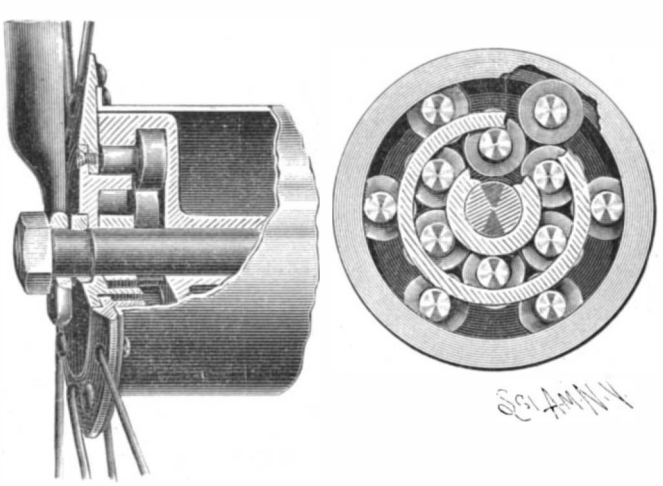
world, including China, Japan, Mexico, Central and South America, South Africa, England and the continent of Europe. The samples have been collected with special reference to the requirements of the various markets; they are intended to show the general lines most in favor. It will be found on examination that in most cases a better article of the same sort can be supplied from the United States at a fair price. The lines represented in the collection will repay expert examination, and such an opportunity to compare goods has never before been offered. Forty-one countries will send delegates to the commercial congress and 126 chambers of commerce will participate.

A ROLLER-BEARING FOR BICYCLES.

A roller-bearing especially adapted for bicycles and machinery has been invented by Philip M. St. Louis, of Carmel, Wis., which, it is claimed, besides being cheap in construction, cannot bind or become disarranged.

Referring to our illustrations, in which the bearing is shown applied to a bicycle and in sectional side elevation, it will be seen that concentric tracks are employed, secured to the axle of the bicycle-wheel, between which tracks is a bearing-ring formed or fastened on a cap attached to the hub of the wheel. Two sets of flanged rollers are employed, lying between the bearing-ring and the concentric tracks. The flanges of one set of rollers roll upon the flanges of the other set, the concentric tracks being grooved alongside their bearing-surfaces to receive the flanges, but without contacting with their peripheries. When the axle of



ST. LOUIS' ROLLER-BEARING FOR BICYCLES.

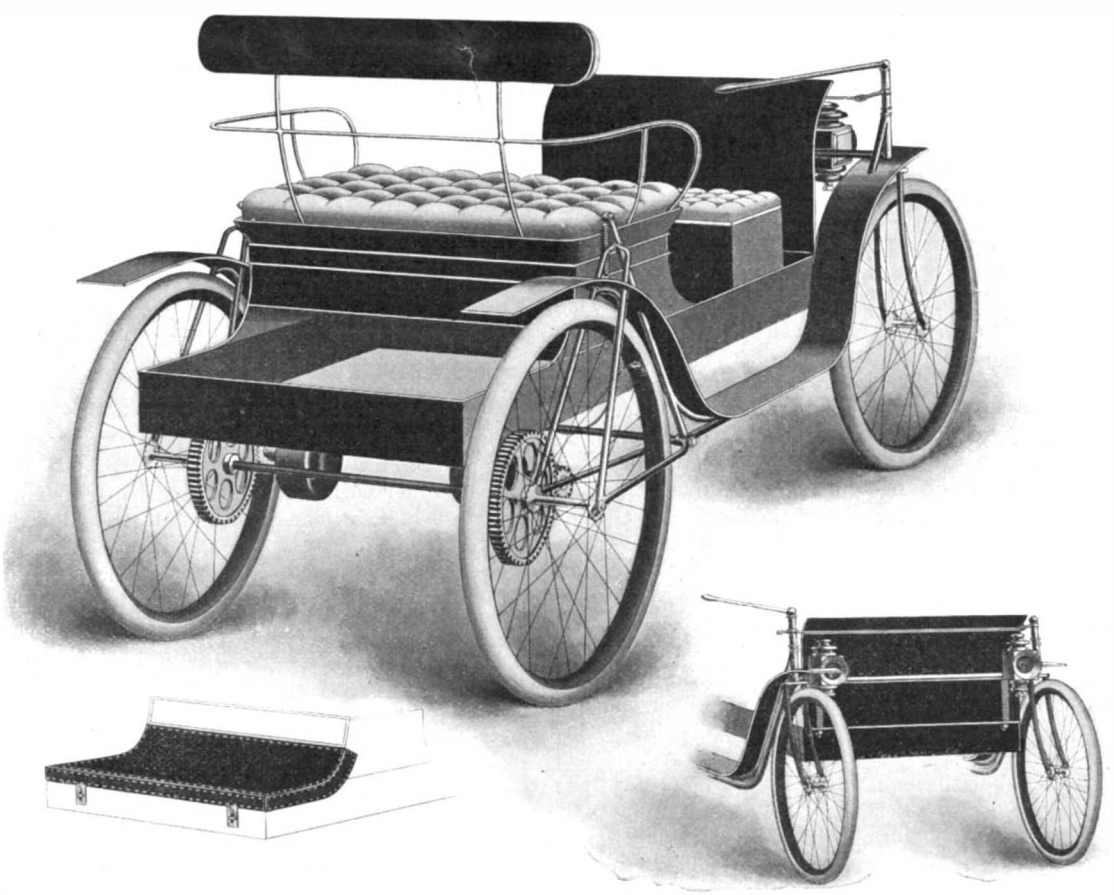
the wheel is turned, the sets of rollers, being in contact with the inner and outer surfaces of the rotating bearing-ring, are made to turn in opposite directions and roll upon the fixed, concentric tracks. The flanges, besides separating the rollers, cause them to turn in unison.

By arranging the parts in this manner, the bearing-ring is placed between two sets of bearing-rollers, thereby forming double bearing-surfaces sustaining the weight equally. The load is directed against the outer set of rollers at the bottom and bears against the inner set at the top, thus reducing the friction to a minimum so far as the vertical stress is concerned.

THE CHAPMAN ELECTROMOBILE.

The chief objection to electric automobiles is their great weight and their limited radius of action. The advantages of electrically operated vehicles is their ease of operation, safety and freedom from vibration. This makes them great favorites for the city, but their weight interferes with their general use for every-day purposes in the country. Our engraving shows a very light carriage built on the bicycle principle which does away with many of these objections. It was designed by Mr. W. H. Chapman, of Portland, Maine. Its weight is only 380 pounds. The bicycle frames were made by a well known firm of makers of wheels, and the motors were made by the Belknap Motor Company. The wheels are 32 inches in diameter and are equipped with 4-inch pneumatic tires. The light skeleton body is hung between them. Although only intended for light work, the first carriage of this type has been used for a two weeks' tour in the country, always, of course, keeping in reach of an electric light plant.

There are two motors of one-half horse power. Each is geared to a rear wheel by means of a 10-inch gear wheel and a pinion giving a reduction of 10 to 1. Each is run independently. The storage battery is in front and may be used as a child's seat. Owing to their light weight, they can be easily removed for recharging, which operation consumes about two hours. In design the vehicle resembles a light cart, and there is room at the rear for a second battery, so that the distance traveled can be doubled. Ordinarily, the carriage can be run 20 to 25 miles without recharging and the speed is from 15 to 20 miles per hour. The steering lever is in front at the right and the manipulating lever is in front of the seat. Owing to its lightness, it can be turned, stopped and started with ease.



THE CHAPMAN BICYCLE FRAME ELECTROMOBILE.

The Museum of the Royal College of Surgeons.

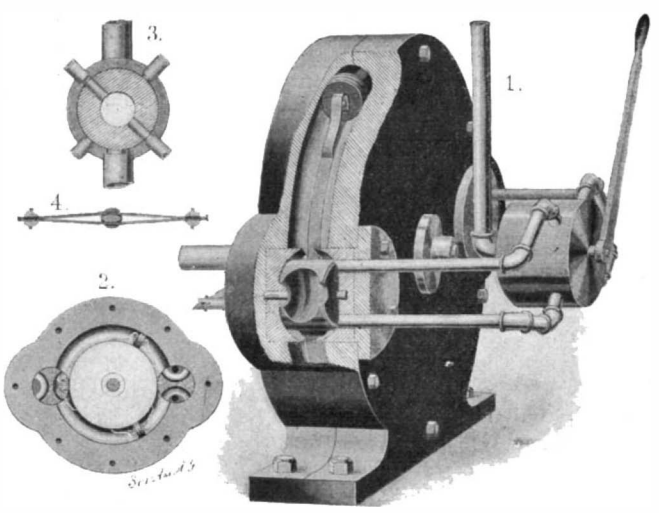
On the south side of Lincoln's Inn Fields lies the Royal College of Surgeons with its great museum behind, containing the Hunterian collection. The building houses one of the most remarkable collections of everything which bears upon the medical sciences. The museum was endowed by John Hunter, who a century ago came to London to learn surgery. He became possessed with the idea of starting a medical and surgical museum in which every form of health and disease should be presented. He spent $350,000 in his own lifetime on his pet project, every cent of which he obtained by medical practice. He died in 1793, and it took six years to induce the government to spend $75,000, which was all that was required for the purchase of the collection. It was bought by the nation and turned over to the custody of the Royal College of Surgeons, and the same amount was given to house it. The college itself has spent over $2,000,000 in amplifying and completing Hunter's design, and the Curators of the collection have included William Clift, Richard Owen, Sir William Flower and lastly Dr. Charles Stewart. The museum besides containing skeletons and all kinds of human and pathological specimens, also has many curiosities, such as the clothes of a man struck by lightning, and there are many specimens illustrating miraculous recoveries from injuries usually considered fatal. In one gallery there are the surgical appliances of all kinds, and here may be seen samples of instruments of the Roman surgeons, 300 years B. C., and also samples of the products of a Roman artificial limb manufactory.

Russian Weights and Measures.

By a recent ukase a standard of Russian weights and measures has been fixed. The unit of weight is the Russian pound, equal to 409,512 grammes, a vedro or pail must hold 30 pounds of distilled water at 16⅔ degrees Celsius, while the garnietz must equal 8 pounds of water. The unit of length is the arshin, equal to 71·12 centimeters. The metric system may be used by the side of this.

A ROTARY ENGINE WITH IMPROVED ABUTMENTS.

The rotary engine which we illustrate herewith is an improvement made by its inventor, James J. Callihan, of 2020 Melpomene Street, New Orleans, La., upon a similar engine which he has patented. Of our illustrations, Fig. 1 is a perspective view of the engine with parts broken away; Fig. 2 is a sectional side elevation; Fig. 3 is a section through the reversing-valve; and



DETAIL AND PERSPECTIVE VIEWS OF ROTARY ENGINE.

Fig. 4 is a detail showing the means employed for holding the abutment-valves in their normal positions. The novel features of the invention are found in the use of these abutment-valves and in their mode of operation.

The engine-cylinder is formed of two disks bolted together and provided with recesses in which the piston and its three heads rotate. Tangent to the inner sides of the circumference of the piston-disk and extending through the cylinder are two apertures which receive blocks which are concaved at their inner faces to form chambers for the abutment-valves and which are provided with steam-ports controlled by the abutment-valves. Caps cover the outer ends of the apertures and can be adjusted by means of screws to force the blocks snugly upon the abutment-valves. The abutment-valves are journaled in the block-chambers and are provided with peripheral cavities receiving and passing the piston-heads. One of the abutment-valve journals projects from the engine and has a flattened end (Fig. 4), which is embraced by flat plate springs whose function it is to hold the valves normally in position.

Steam enters the cylinder through the ports upon opposite sides of the chamber which receives the abutment-valves. When the abutment-valves are in position shown at the right of Fig. 2, the ports are open. Steam can then pass through one port into the cylinder; while through the other port the exhaust escapes from that portion of the cylinder on the opposite side of the abutment-valve. As piston-head passes the abutment-valve, the inlet ports are closed as shown to the left of Fig. 2.

By means of the reversing-valve illustrated in Fig. 3, steam can be made to enter at either side of the cylinder, so as to cause the piston to rotate in the desired direction.

Blue Rays of Sunlight Over Mont Blanc.

Lord Kelvin, writing to Nature from Aix-les-Bains, says that at five o'clock on August 27, from the balcony of the hotel, 1,545 meters above sea level and 68 kilometers from Mont Blanc, he had an opportunity for observing what he had been anxious to see for five or six years, which was the earliest instantaneous light through very clear air and find whether it was perceptibly blue or not. He was amply rewarded for his pains. He saw a blue light against the sky on the southern profile of Mont Blanc, which, in less than one-twentieth of a second, became dazzlingly white, like a brilliant electric arc light.

A FEW days ago three waterspouts passed Altantic City, N. J., and narrowly escaped coming in contact with several yachts. The waterspouts passed at an estimated distance of three miles from the coast.

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The Island of Sulphur.

About thirty miles from the shore in the Bay of Plenty, North Island, New Zealand, is an immense rock or rather series of rocks three miles in circumference which rise precipitously from the sea to a height of 860 feet. "White Island" is the name given to the spot, and the name is particularly appropriate because it is constantly enveloped in thick impenetrable clouds of white vapor which rise to over 10,000 feet in height, making White Island a conspicuous object for many miles around. It is perhaps the most extraordinary island in the world, and it is the subject of an interesting article by James R. Falconer in the September number of The Windsor Magazine, and from this article we obtain our facts.

The island is practically one mass of sulphur, while the clouds of vapor constantly rushing from the craters are highly charged with acid fumes, which can be noticed sixty miles away. The appearance from the sea is most imposing, the rocks rising abruptly from the waters. At first sight it seems impossible to effect a landing, but as the steamer sweeps around the south side of the island into Crater Bay, a beach comes into view, which though small is sufficient to admit of disembarkation provided the sea is calm. This is the only level stretch on the island, the rest being great irregular rocks.

In the center of the island is an immense lake 50 acres in extent and 12 feet deep and it is 15 feet above the level of the sea. The water contains vast quantities of acid and the temperature is about 110° Fah. It is dark green, and dense clouds of dark sulphurous fumes are constantly rolling off from this boiling caldron. At one side of the lake are blowholes, and the roar of steam as it pours forth into the air is deafening, and huge bowlders and stones are often hurled to a height of several hundred feet.

A boat brought from the ship can be launched on the lake, and the very edges of the blowholes may be safely explored, but the trip is by no means an enjoyable one, and only those who have inhaled fumes of acid can form any idea of their very overpowering nature when given off in large quantities from such an expanse.

Should the boat upset, death would be almost instantaneous. When the boat was taken to the sea, it became so corroded that it dropped to pieces after all the passengers had been landed. The mouths of the blowholes are weird in extreme. Steam belches forth from every fissure and crevice in the rocks and ground, while the noise drowns all other sounds. The whole island is in a ceaseless state of agitation.

Except in the immediate neighborhood of the craters no sulphur is apparent on the surface, but by digging a little into the earth large beds of this mineral will be laid bare, for the island is practically one mass of sulphur mixed with a quantity of gypsum and one or two other substances. The White Island sulphur is much esteemed on account of its purity, and it can be employed for any purpose without any preliminary preparation. The older deposits contain about 90 per cent pure sulphur, and that around the blowholes 98 per cent. It is surprising that these immense deposits have not been more systematically worked. Some years ago a company was formed for working the deposits, but for lack of capital the scheme was abandoned and the amount of sulphur and gypsum exported at present is very small. In the event of a serious war, doubtless the island would immediately rise to prominence.

Did Man Once Possess a Third Eye?

This query heads the following statement in a recent number of The Evening Telegram:

Deep researches as to the structure of the human body have recently furnished some startling facts regarding changes which man is at present undergoing physically.

It is believed that man was formerly endowed with more teeth than he possesses now. Abundant evidence exists that, ages and ages ago, human teeth were used as weapons of defense. Unintentionally, traces of such use are often revealed by a sneer. The teeth are sometimes bared, doglike, ready, as it were, for action.

The practice of eating our food cooked and the disuse of teeth as weapons are said to be responsible for the degeneration that is going on. The wisdom teeth, in fact, are disappearing. Human jaws, found in reputed Palæolithic deposits, have wisdom teeth with crowns as large as, if not larger than, the remaining molars.

In ancient times a short-sighted soldier or hunter was almost an impossibility; to-day a whole nation is afflicted with defective vision. It is almost certain that man once possessed a third eye, by means of which he was enabled to see above his head. The human eyes formerly regarded the world from the two sides of the head. They are even now gradually shifting to a more forward position.

In the dim past the ear flap was of great service in ascertaining the direction of sounds, and operated largely in the play of the features. But the muscles of the ear have fallen into disuse, for the fear of surprise by enemies no longer exists.

Again, our sense of smell is markedly inferior to that of savages. That it is still decreasing is evidenced by observations of the olfactory organ. But the nose still indicates a tendency to become more prominent.

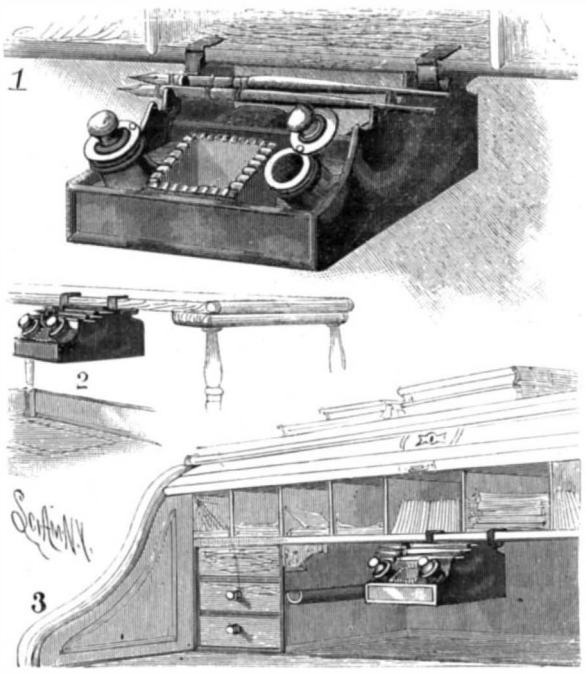
THE HAYNE SUSPENDED INK-WELL.

The inkstand in general use up to the present time monopolizes the most valuable space on a desk, and is often a menace to books and papers because of its liability to be overturned, and usually necessitates an inconvenient reach every time the pen is filled.

The advantages of removing the ink from the surface of the desk are so obvious that it seems strange the suspension arrangement—practically applied in the Hayne Suspended Ink-Well illustrated herewith—has not been sooner employed.

The Hayne ink-well is manufactured by the Universal Specialty Company, of 151 Chambers Street, New York, and consists of a metal frame, the sides of which are provided with lugs, whereby it can be readily suspended from the bottom shelf of one of the pigeon holes of a roll-top desk by means of strong spring clips, or from the rack above a bookkeeper's desk. Within the frame are two flint glass ink bottles and a sponge cup. A third ink bottle can be substituted for the sponge cup when desired. The ink bottles are fitted with hard rubber tubes in such a manner as to render them air-tight and dustproof, preventing all evaporation and congealing of the ink.

The construction of the bottle is such that the pen can be submerged only to a certain depth, thus the ink bottles which may hold two kinds of ink can be easily



SUSPENDED INK-WELL.

filled or cleaned by removing the front plate of the frame.

The entire table surface of the desk is left free and clear, and the device can be put on or taken from the desk in a moment.

When You Weep—and Why.

Tears are the common legacy of every human being, and if you should be asked whence they come and where they go, you would probably display a surprising amount of ignorance about a very simple subject. A writer in The Evening Telegram enlightens its readers as follows:

Our eyes are always wet with tears, not only when we weep, but always. Our eyeballs are subjected to a constant flow of the lachrymal fluid, even when we are asleep, and were the stream to cease only for an hour, miserable indeed would be the lot of the human creature.

At the outer corner of every eye is what is called the lachrymal gland, which nestles under the overhanging bone of the forehead. This organ secretes the fluid which flows over the eyeball to the inner corner, and there it disappears through a little orifice, whence it is in turn conducted to the nostril. That is why you require so many extra handkerchiefs when you have a cold.

Now comes the question, How do the tears find their way to the nose? Examine your eye in the mirror, and you will find a small elevation upon the lower eyelid, near the nose. Place your finger upon the lower eyelid just below this small elevation, so as to turn it outward. There you will see a small hole, like a pin prick, and there you have found the little passage which conducts the tears into the nostrils.

This little orifice, for various causes, frequently becomes obstructed, in which case you are bound to weep incessantly until relief is afforded you by the removal of the obstruction.

The overflow of tears which follows some great grief is created by the lachrymal gland under pressure of mental emotion.

Why are tears salt? Literally, our tears are distilled from the very springs of our inmost vitality, for they are separated by marvelous machinery and chemistry from the arterial blood freshly circulated from the heart; and as this contains about six or seven parts in one thousand of saline constituents, so tears contain one-third per cent of chloride of sodium, besides a very small proportion of other salts, ninety-eight per cent being water. The office of this alkaline fluid is to clear, clean and moisten the cornea, which, having no blood vessels, would, of course, wither and dry up without this moisture, and we should become blind.

Thermodynamics of the Human Machine.

In a paper published recently in the Comptes Rendus, M. A. Chauveau gives particulars of a series of experiments made to determine the thermodynamic economy of the human machine. The apparatus consisted of a pair of treadmills, each three meters in diameter, mounted on the same shaft. One of these treadmills was surrounded by a small chamber which was calibrated as a radiation calorimeter. A brake could be applied to either wheel at will and served to both regulate the speed of rotation and to measure the energy exerted. The speed chosen was 80 revolutions per minute, which, with necessary corrections, corresponded to an effective work of 68 calories per hour. The calibration of the calorimeter was effected by means of an electric current passing through heating coils in the chamber. It was thus easy to determine the output of heat required to maintain this chamber at any given temperature above that of the room in which it was placed. According to The Engineering and Mining Journal, the first series of experiments gave very uniform results. When the subject was doing useful work at the rate of 64 calories (units) per hour, he also radiated from his body extra heat amounting to 199 calories per hour. The efficiency of the human mechanism was therefore about 24·3 per cent.

Automobile News.

The Motor Age has just appeared in Chicago and is published by the Cycle Age Publishing Company. It is filled with a number of interesting articles and will undoubtedly prove interesting to its readers. The form, however, is rather small for a paper devoted to motor carriages.

The Automobile is published at 150 Nassau Street, New York city. There are now two papers issued under this name, and The Automobile Magazine will be a third. The specific Automobile to which we refer consists of sixteen pages and contains a number of articles and notes on the automobile industry. It is quite well illustrated.

There is one place in New York where electric carriages are received and stabled and batteries charged at any time during the day. The batteries are charged in position or put on a small truck and taken to the charging-room. In a short time there will probably be facilities for charging storage batteries in every large stable in our cities.

American Enterprise in Siam.

A former citizen of New Haven, Conn., Mr. Wallace J. Palmer, in traveling about the world, especially in the Far East, was particularly pleased with Siam. Having had some experience in operating Florida hotels, he opened one on a small scale in Siam. The American patronage made him prosper, and among the visitors was the King of Siam, who after a few visitations liked the place so well that he made Mr. Palmer his chief caterer.

The relations between the two grew quite cordial until the king at last generously gave Mr. Palmer a large plot of land in the center of the city of Bangkok, on which he is to erect a $200,000 hotel structure. Land in Bangkok is said to be quite expensive. This practical recognition by the king of American enterprise is another example of how American ideas are being advanced in foreign countries.

Microbes in Telephones.

According to The Medical Record, Dr. W. H. Hill, of the bacteriological laboratory of the Boston Health Department, recently made an examination of thirteen public telephones in that city. In several of the transmitters harmless microbes were found, but an inoculation of guinea pigs failed to reveal the presence of any pathogenic micro-organisms. The report states, however, that this examination has demonstrated the possibility of infectious diseases, particularly diphtheria and tuberculosis, being conveyed from one user of the telephone to a subsequent user. He suggests that the receiver as well as the transmitter be also cleaned and disinfected. Precautions of this nature are more necessary in public than in private telephones, as in many cases public telephones are used by persons who are unfamiliar with the instrument and insist upon placing their lips in close contact with the transmitter.

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Science Notes.

Capt. Bulatowich, the head of the Russian Abyssinian expedition, has discovered in South Africa a hitherto unknown range of mountains; it has been christened Emperor Nicholas II. Range.

Pencils made from slate dust moulded by hydraulic pressure are made in large quantities in Tennessee. They are much more popular than the solid-cut slate pencils. One concern last year made 25,000,000 moulded pencils.

At the Pasteur Institute in Paris, 1465 persons were treated in 1898, and all but three were cured. For the thirteen years from the foundation of the Institute to the end of the year 1898, 13,181 persons were treated in Paris, and out of this number only 99 died.

Mr. Walter Wellman arrived in London August 28, and has undergone the first surgical operation for straightening his right leg, which was severely injured when he fell into the snow-covered crevasse during his polar expedition. The operation was entirely successful.

By a fall of rock which occurred recently at Niagara Falls the Horseshoe Fall has again been restored to its proper shape from which it derives its name. Of late years the Fall has been nearly V-shaped, destroying much of its natural beauty. From 1842 to 1890 it is stated that 275,000,000 cubic feet of rock had fallen away.

The lighting of the Paris Exposition will call for 20,000 horse power. At the Paris Exposition of 1853, the motive power was only 350 horse power; in 1867, 626 horse power; in 1878, 2,500 horse power; in 1889, 5,500 horse power; in 1900 it is thought that 45,000 horse power may possibly be needed, but about one-half that will probably answer.

On Sunium's marble step the excavators have laid bare the foundations of the thirteen marble columns that give the promontory its modern name, Cape Colonna, and have found inscriptions showing that the temple was dedicated to Poseidon and not to Athene, as was supposed. It corresponds with the temple of Poseidon on the island of Aegina opposite.

An aquarium will be one of the attractions at the Paris Exposition. A dark incline will lead visitors to it, and suddenly they will feel as if transported to the very bottom of the sea, in the midst of marine landscapes and inhabitants of the ocean. Immense glass tanks will form the aquarium proper; the buttresses, pillars and girders which will form the frames of the tanks and hold the glass together will be entirely concealed under rocks.

A pair of joined twins resembling the Siamese twins were recently presented before the Academy of Medicine of Rio Janeiro, Brazil. According to The Medical News, they were united by a band of soft tissue at the upper part of the abdomen, posteriorly and laterally. It was thought that an operation for the division of the band seemed feasible, but incision into the band revealed the fact that the kidneys of the twins extended through it and that this division might prove fatal, and the operation was abandoned.

On July 19, between 8 and 9 o'clock P. M., in the vicinity of Erie, Pa., according to The American Naturalist, the waters of Lake Erie suddenly rose in a single wave about 6 feet high which advanced upon the shore, and after a few moments quietly subsided to its normal level. Five miles west of Erie the rise was between 3 and 4 feet. Three distinct rises were observed. The first and second rises were about fifteen minutes apart, the second and third about half an hour apart. Fifteen miles east of Erie the rise was about 6 feet, and but one wave was observed.

An Irish lord has found it necessary to invoke the aid of the divining rod in order to obtain a water supply for his property. A Dublin professor has been investigating the phenomena connected with the rod and has arrived at a conclusion which is favorable to divination. He believes that hidden water exerts an influence over the muscles of the person holding the rod, and the involuntary twitching gives the signal. There is so much water in Ireland, however, that there is nothing remarkable in discovering water in almost any part of the country. Divining rod frauds are rampant in the United States, and evidently they are not less frequent in Great Britain.

A section of the famous mpundu tree at Chitambo's, which marks the place where Dr. Livingstone died, has been removed and will be sent to England for preservation. Two or three years ago, Mr. Weatherley visited Chitambo's and reported that the tree was in an advanced state of decay and would probably disappear altogether in a short time. The Royal Geographical Society decided that the best course to pursue would be to cut out the section of the tree which bears the inscription and have it sent over to England for preservation in the rooms of the Society. The place where the tree stood is marked by two telegraph poles held in place by stays of telegraph wire, and a large stone cairn has been erected around these poles. In time it is expected that a permanent memorial will be built.

Engineering Notes.

A great gas holder has just been completed for the corporation of Birmingham, England, which is 264 feet in diameter and 160 feet high when extended to its full height. Its storage capacity is 8,250,000 cubic feet.

There were three hundred and twenty-five competitors for the prize for an improved garbage and refuse wagon, which was offered some time ago by the London County Council. The accepted design has four sliding covers, with wind guards raised eight inches above them; it has also a tipping screw.

The tides are now utilized for generating power at Pont l'Abbé, Finisterre, France, during fourteen hours a day. At flood tide the water flows through the canal two and one-half miles inland into a pond in the rear of the power house, and returns to the sea at ebb tide. The total fall is 7½ feet, and 80 horse power is generated by turbines.

The Illinois Central Railroad is experimenting with an inspection car driven by a gasoline motor. The experiments have been very successful, and it is probable that the road will adopt this kind of a car on all its divisions. It is really an "automobile of the rail," and should come into general use where the old hand-work inspection cars are used. Twenty-five miles an hour is the average speed of the car. A gallon of gasoline will ordinarily run the car for seventy-five miles.

Russia has objected to the Sultan's mounting pneumatic guns at the northern entrance to the Bosphorus, on the ground that such action implied that he doubted the Czar's friendliness. The result is that the Sultan has canceled the contract for the pneumatic guns, which were the work of a New York company. It is said that the Sultan got the idea of employing pneumatic guns from the accounts of the actions of the United States dynamite cruiser "Vesuvius" in the war between the United States and Spain.

There is a small station on the Chesapeake and Ohio Railroad, near Cincinnati, called California. The town had developed away from the station, and the railroad company has moved it to the center of the town. The building measured 60×25 feet and was one story high. Iron shoes were fixed under the structure, which was raised by jacks. An engine was then hitched on, the rails were greased between the engine and the building, and in exactly four minutes the station was conveyed a third of a mile and the men were rolling it on a new foundation. The work of changing the location of the station occupied only one hour and fifty minutes.

For the Suez Canal Company Messrs. William Simons & Company, Renfrew, are about to begin the construction of a great hopper dredger. The vessel, which is specially intended for improving the entrance of the canal at Port Said, will be 270 feet in length, 48 feet in breadth, and 19 feet deep amidship. She will have hopper capacity for 2,200 tons of dredging, and the bucket-ladder will dredge to a depth of 40 feet. The lifting capacity of the vessel will be 1,500 tons per hour, each of the buckets lifting about two tons of material. Messrs. Simons & Company have also recently received an order to construct a powerful twin-screw dredger for Japan.—The Engineer.

The United States steamer "Michigan" is said to be the oldest iron steamboat afloat. It was constructed at Pittsburg, 1841–43. The parts were transferred to Erie, put together and launched in 1843. The original machinery, with the exception of the boilers, is still in her and in good condition, and, according to Cassier's Magazine, there are two direct-acting engines, the paddle wheels being of the radial kind, 21 feet 6 inches in diameter. The vessel has been in continuous service until the present time, over fifty-five years, and is apparently as good for service as ever. Her armament is six 6-pounders, two 10-pounder rapid-fire guns, and two machine guns. Of late years her principal occupation has been in the instruction of the United States naval militia at the different lake ports.

Trials have been recently made in England of a device for shutting a railway carriage door, the object being to enable the guard to close and lock all of the doors of the train simply by turning a handle in his compartment, which we would call a "caboose." According to The Practical Engineer, compressed air was the agent employed, and was conveyed along the train by the aid of flexible couplings like those used for the Westinghouse air brake. Under each coach is fitted an air cylinder with a piston actuating a pair of horizontal rods which slide in guides under the footboards on each side of the train. The doors are connected by suitable devices so that when the guards bring the rods into action, with the aid of air valves, the doors are opened simultaneously. A spring connection renders the whole operation very gentle and noiseless. If the passenger's finger should be in the way, it would only prevent the door from closing, and would not injure it. The locking is managed in a similar way, and it is an extraordinary thing that abroad railway passengers have accepted for so long a period such crude fastenings for railway doors, and the new device is a step in the right direction.

Electrical Notes.

The British Association for the Advancement of Science, at Dover, exchanged courtesies with the French Association, at Boulogne sur-Mer, on September 13, by means of wireless telegraphy.

A plant capable of developing 12,000 horse power has been built at Snoqualmie Falls, and the current will be transmitted to Seattle, twenty-six miles away. The falls are 270 feet high. The transmission line is to be of aluminum, which has been made by the aid of water power at the Niagara Falls works.

The Niagara Falls Power Company has called for bids for the construction of a new wheel pit. This pit will be over 400 feet long, 20 feet wide and 180 feet deep. It will be located on the inlet canal opposite the present power plant. There will be room for at least ten 5,000 horse power turbines in this pit.

An electric telemeter for indicating gas pressure has recently been successfully tried in Detroit, where the pressure at the office in the city is communicated to the gas works, a voltmeter being used which is calibrated to read in terms of gas pressure, and a recording instrument is connected in parallel to it so that a permanent record of variations and pressures is kept.

The burning out of the fuse on one of the new motor cars of the Fifth Avenue line of the Brooklyn Elevated Railroad, September 11, resulted in a fire which almost destroyed the car and badly damaged the other car which it was drawing. The accident was the first of its kind in connection with the third rail system in Brooklyn. The fire department was called out, and the conflagration was extinguished.

A Brooklyn trolley car, at Sands and Adams Streets, jumped the switch, bumped over the tracks on the road, and brought up with a crash against the front of a house. The car, after leaving the tracks, had leaped the curb on the opposite side of the street, mowed down an iron fence, and struck the front of the building with much force. A wrecking car was sent for and the car was pulled out of Dr. Bodkin's front yard and replaced on the rails.

Electricity from a traveling crane injured one of the workmen in a large concern which builds steam engines. He sued the company for damages, and has recently obtained a decision in his favor, in the Rhode Island Supreme Court. The men have been shocked a number of times, and rubber gloves have been furnished to them. The court held that the insulation between the motor and the hauling chain should be so complete that its use would involve no risk of injury by electricity.

The Canadian Niagara Power Company has commenced preliminary work in connection with the development of power of the Canadian side of the river, by awarding the contract for boring testing holes along the line of the tunnel it contemplates building. The test holes will be 200 feet deep and 4½ inches in diameter. They will be bored with a diamond drill in order that a core of the rock will be brought to the surface and saved for inspection by contractors who desire to bid on the work.

Long distance telephone conversations, or rather a series of conversations, recently occurred between parties in New York and St. Louis. The total cost of them was said to be about $3,000; most of the talking was done at night, and the bill for one continuous conversation amounted to $716. This figure indicates that the talk must have lasted into the high-priced day hours, for anyone can converse from eight o'clock in the evening to six o'clock in the morning for $600, the rate being $1 per minute. Special care was taken to avoid interruption by operators cutting into the line.

A. Hecker, in Zeitschr. Elektrotechn., states that trolley poles must be allowed considerable up-and-down play in cases where the height of the overhead conductor above the rails is very variable. It often happens that when a trolley leaves the wire, the pole breaks a number of guard wires before the car comes to a rest. The author proposes to dispense entirely with springs in the trolley base and to substitute for them a coil and plunger mechanism traversed by the main current. If the trolley should be thrown off the conductor, the excitation of the magnet ceases and the trolley pole falls down by gravity out of harm's way.

An extraordinary accident occurred to a trolley car at Sing Sing, N. Y., on September 11, which recalls Robert Louis Stevenson's "Dynamiter," in which a man carrying a box of dynamite is jostled by a woman so as to cause the explosive to fall, though it does not explode. In the present instance a ton of dynamite was on a cart when it was struck by a trolley car, and a wheel was taken off the wagon and the vehicle was turned over. The driver of the wagon fell back in a half faint, and he knew it would be useless to run, even if he had not been paralyzed with fear. The motorman was also so frightened for a moment that he could not back away from the wreck. One of the passengers yelled "Dynamite," and they all beat a precipitate retreat, and there was little curiosity evinced when a new wagon was obtained and the dynamite was transferred.

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NAVIES OF THE WORLD.

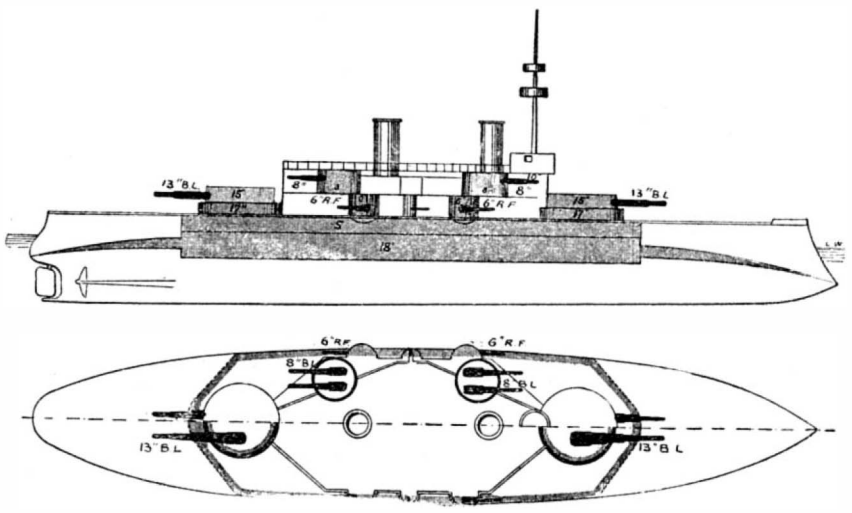
VIII.—UNITED STATES.

With the present article on the United States navy, we bring to a close the series on the navies of the world which has appeared in the SCIENTIFIC AMERICAN at regular intervals during the past few months. The return of Admiral Dewey and the completion of the two latest battleships of the new navy form a conjunction of circumstances that renders the publication of an article on the American navy particularly opportune, the one event calling to mind the men and the other the material that have united to raise the American navy to its present high standing among the navies of the world.

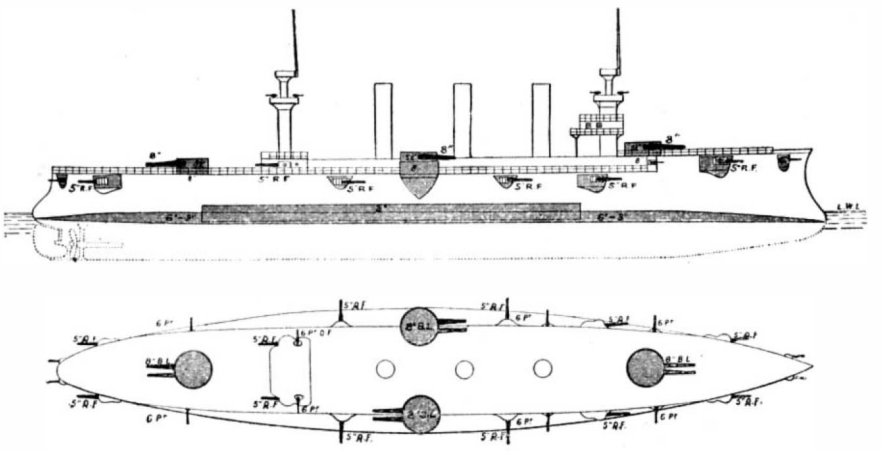
It will be remembered that, as an introductory article to this series, we published a comparison of the strength of the various navies as represented by the ships that were either built or building at the beginning of the year 1899. In that comparison we found that judged on a basis of total displacement and reckoning only ships that were fairly well up-to-date, the United States stood fourth in rank, the number of ships and total displacements being as follows:

Great Britain, 290 ships, total displacement 1,557,522 tons; France, 144 ships, 731,629 tons; Russia, 86 ships, 453,899 tons; United States, 67 ships, 303,070 tons; Germany, 73 ships, 299,637 tons; Italy, 65 ships, 286,175 tons; and Japan, 46 ships, with a total displacement of 211,857 tons.

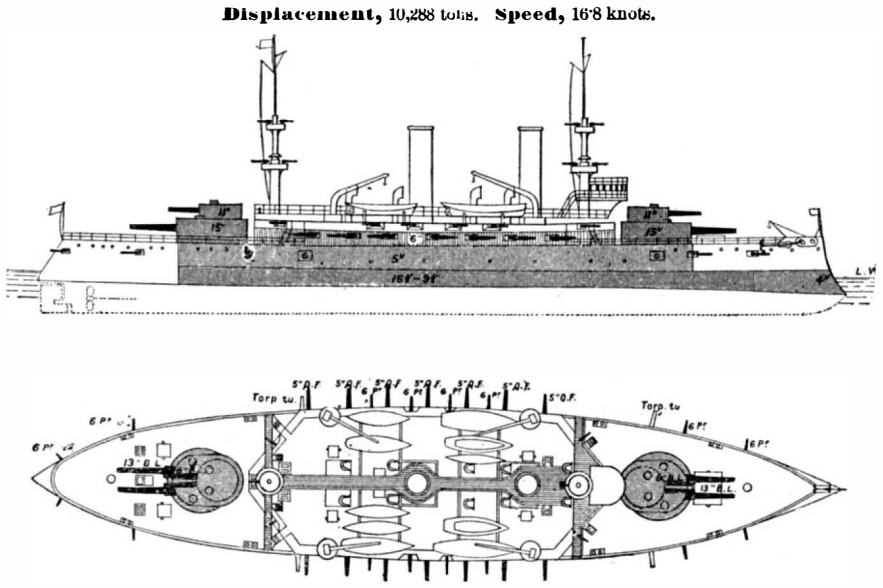
BATTLESHIPS.—In looking over the accompanying table of the ships of the United States navy, one is struck with the fact that the major portion of the displacement represents armored vessels. Of the total displacement, 200,806 tons consists of battleships, monitors, and armored cruisers, while the unprotected cruisers and gunboats represent a total of 110,904 tons. That the new navy should be strong in defensive qualities was to be expected, seeing that in the first decade of its construction our naval policy was laid down on purely defensive lines, and our earliest first-class battleships of the "Oregon" type were officially listed as "coast-line battleships." So also the monitors, five of which were a legacy from the post-bellum and pre-reconstruction period, constitute a purely defensive fleet, a fact which was half understood before the Spanish war, and needed only the test of war to make it a certainty. Latterly, however, the Navy Department has paid special attention to sea-going and



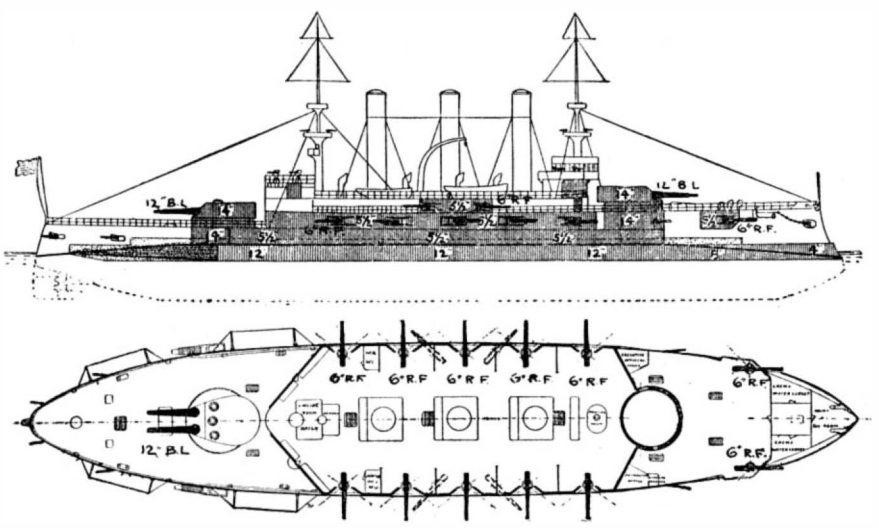
First-class Battleship "Oregon." Class of Three Ships.
Displacement, 10,288 tons. **Speed,** 16·8 knots.



Armored Cruiser "Brooklyn."
Displacement, 9,215 tons. **Speed,** 21·9 knots.

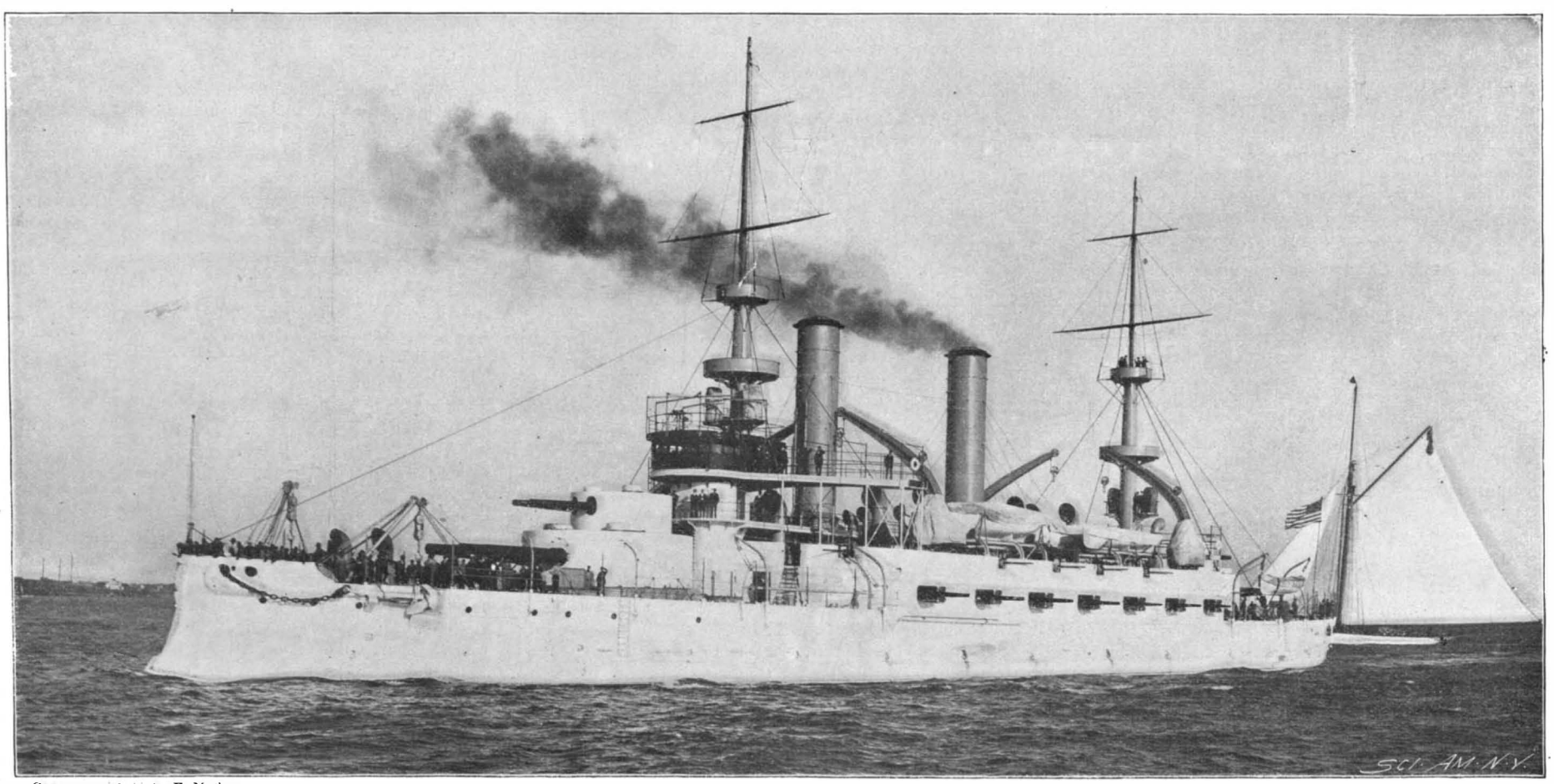


First-class Battleships "Kearsarge" and "Kentucky."
Displacement, 11,525 tons. **Speed,** 17·5 knots.



First-class Battleship "Maine." Class of Three Ships.

Displacement, 12,500 tons. **Speed,** 18 knots. **Maximum Coal Supply,** 2,000 tons. **Armor:** Belt, 12 inches; barbettes, 15 inches; turrets, 17 inches; deck, 2¾ inches on flat, 3 and 4 inches on slopes. **Armament:** Four 12-inch breech-loading rifles, sixteen 6-inch rapid-fire guns, twenty 6-pounders, eleven smaller guns. **Torpedo Tubes,** two (submerged). **Complement,** 500. **Date,** 1899.



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First-class Battleship "Kearsarge." Also "Kentucky."

Displacement, 11,525 tons. **Speed,** 17·5 knots. **Maximum Coal Supply,** 1,645 tons. **Armor:** Belt, 9½ to 16½ inches; deck, 2¾ inches on flat, 3 to 5 inches on slopes; barbettes, 15 inches; turrets 17 inches. **Guns:** Main battery, four 13-inch, four 8-inch B. L. rifles, fourteen 5-inch rapid-fire; secondary rapid-fire battery, twenty 6-pounders, six 1-pounders, four Colts, two field guns. **Torpedo Tubes,** four. **Complement,** 511. **Date,** 1898.

NAVIES OF THE WORLD—VIII. UNITED STATES.

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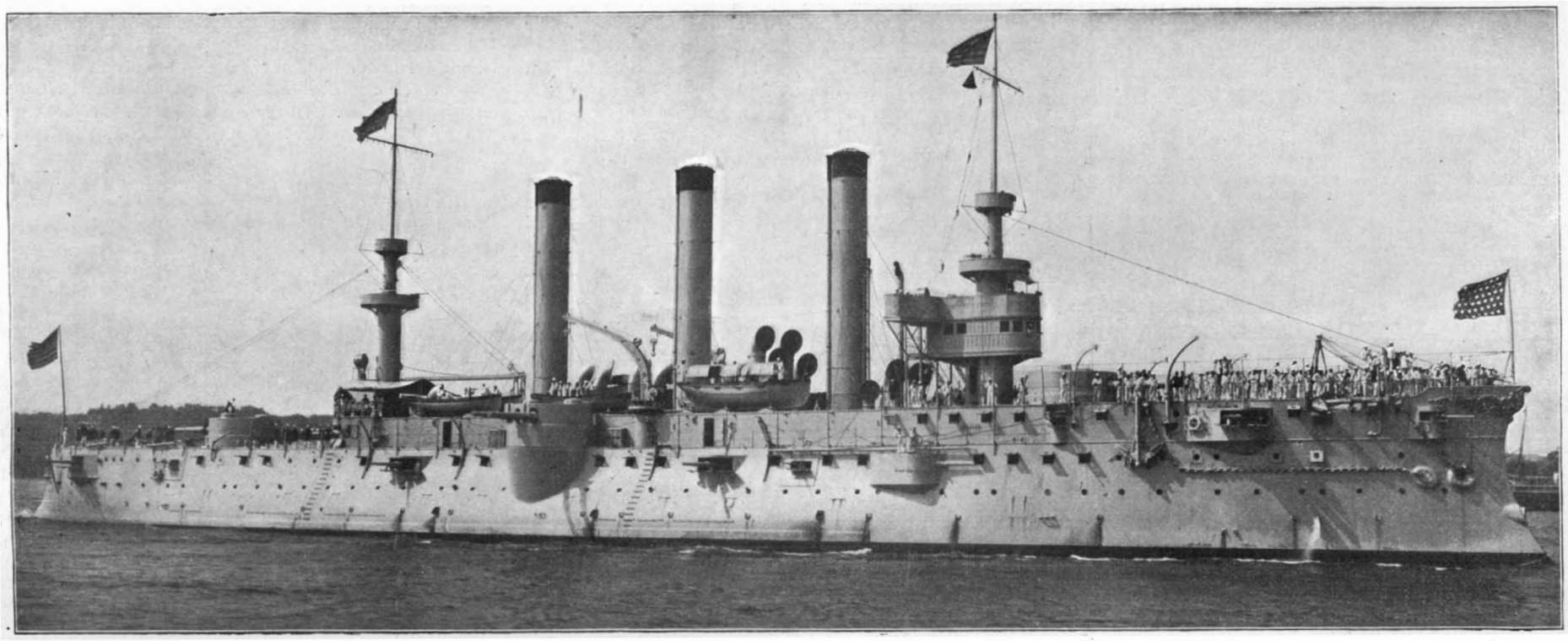
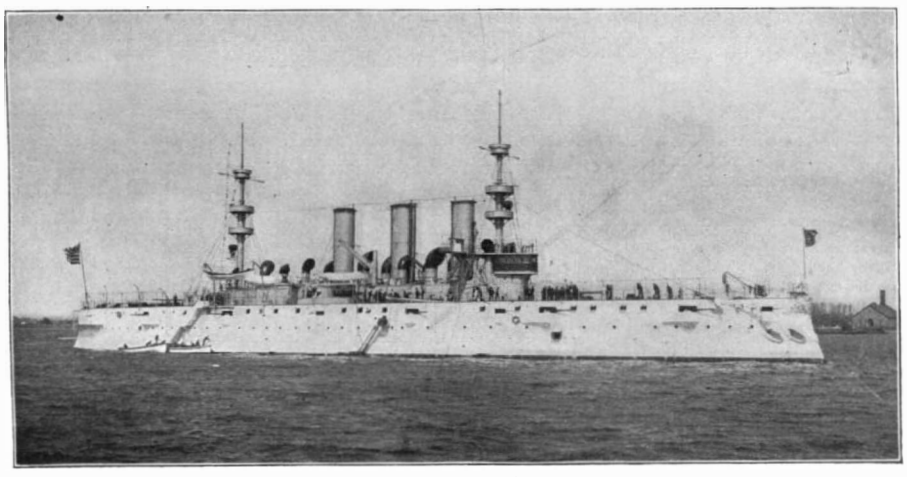
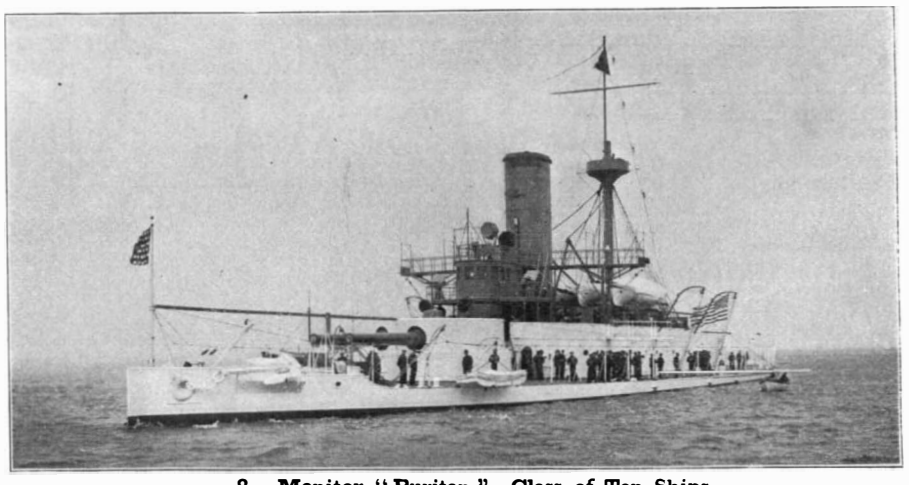


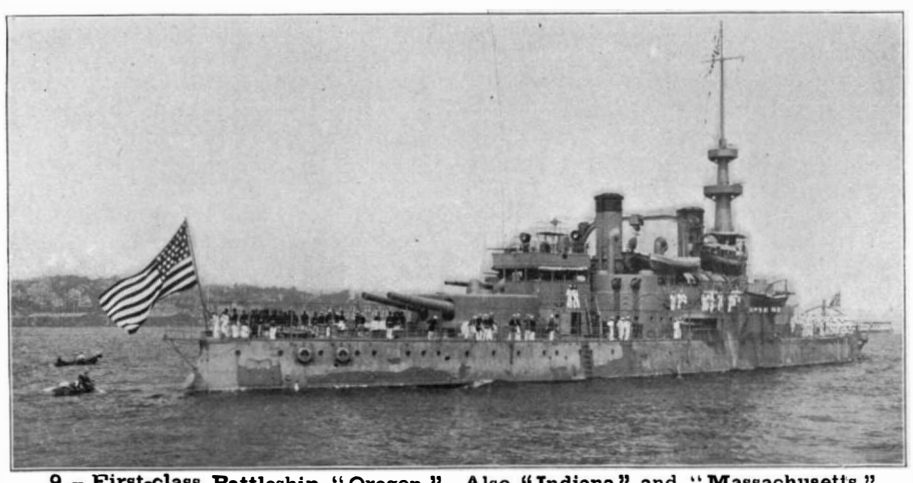
6.—Armored Cruiser "Brooklyn."
Displacement, 9,215 tons. **Speed,** 21·9 knots. **Maximum Coal Supply,** 1,461 tons. **Armor:** Belt, 3 inches; deck, 3 to 6 inches; barbettes, 8 inches; turrets, 5½ inches. **Guns:** Main battery, eight 8-inch B. L. rifles, twelve 5-inch rapid-fire; secondary battery, twelve 6-pounders, four 1-pounders, four Colts, two field guns. **Torpedo Tubes,** four. **Complement,** 516. **Date,** 1895.



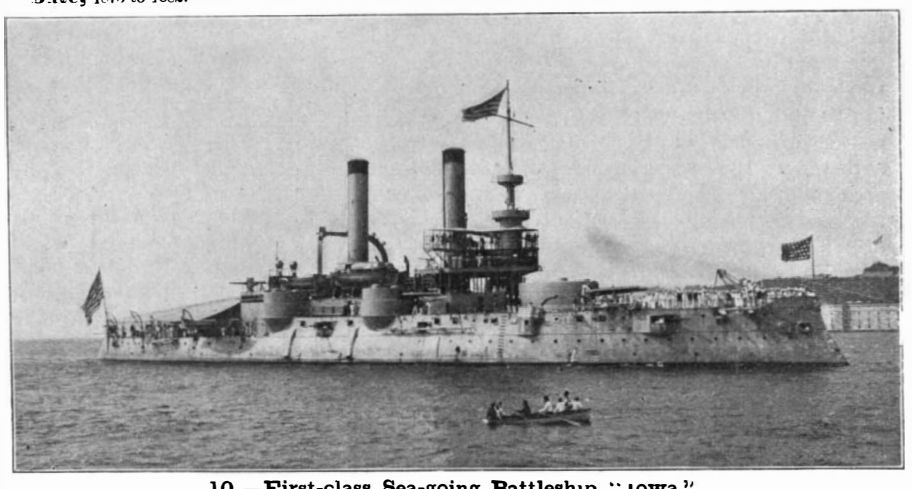
7.—Armored Cruiser "New York."
Displacement, 8,200 tons. **Speed,** 21 knots. **Maximum Coal Supply,** 1,290 ons. **Armor:** Belt, 4 inches; deck, 3 to 6 inches; barbettes, 10 inches; turrets, 5½ inches. **Guns:** Main battery, six 8-inch B. L. rifles, twelve 4-inch rapid-fire; secondary rapid-fire battery, eight 6-pounders, two 1-pounders, four Gatlings, two field guns. **Torpedo Tubes,** two. **Complement,** 556 **Date,** 1891.



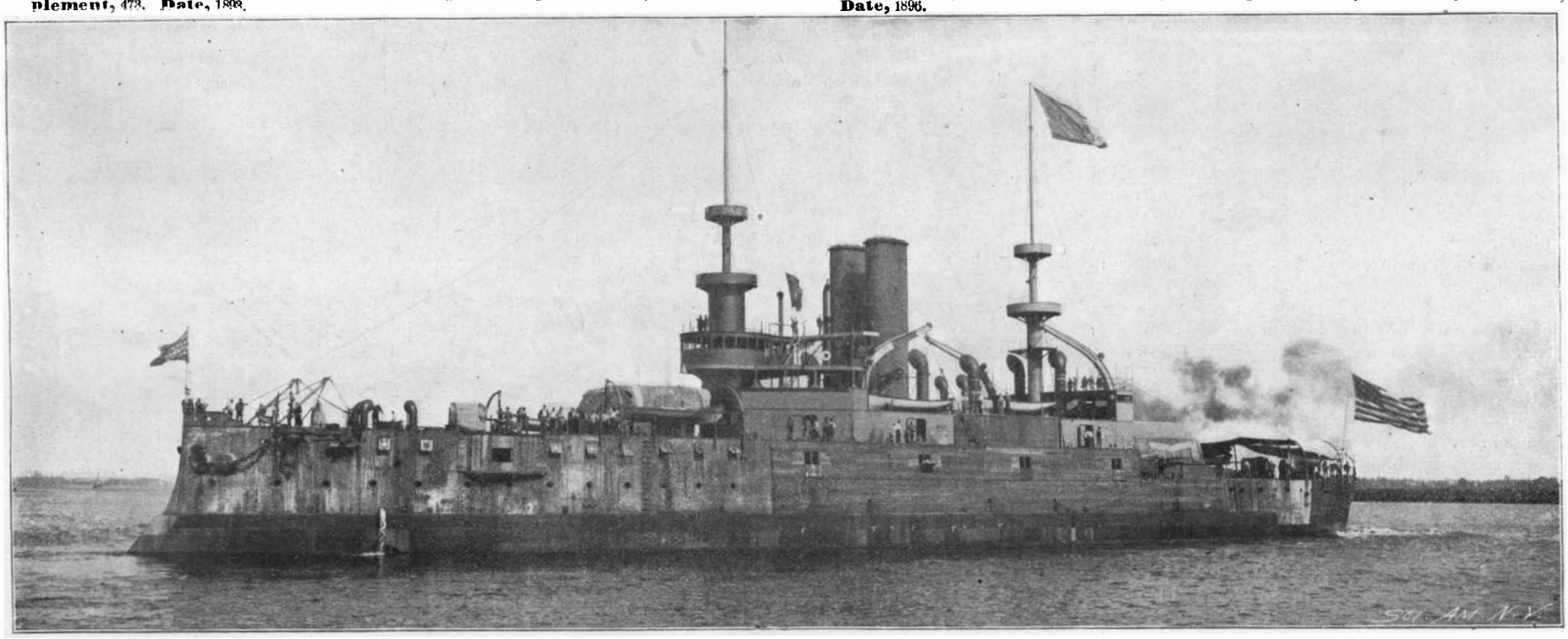
8.—Monitor "Puritan." Class of Ten Ships.
Displacement, 6,060 tons. **Speed,** 12·4 knots. **Maximum Coal Supply,** 314 tons. **Armor:** Belt, 14 to 6 inches; barbettes, 14 inches; turrets, 8 inches; deck, 2 inches. **Guns:** Four 12-inch breech-loading rifles, six 4-inch rapid-fire guns, eleven 6-pounders and smaller guns. **Complement,** 230. **Date,** 1875 to 1882.



9.—First-class Battleship "Oregon." Also "Indiana" and "Massachusetts."
Displacement, 10,288 tons. **Speed,** 16·8 knots. **Maximum Coal Supply,** 1,594 tons. **Armor:** Belt, 18 inches; deck, 2¾ inches; barbettes, 17 inches; turrets, 15 inches; casements, 6 inches. **Guns:** Main battery, four 13-inch B. L. rifles, eight 8-inch, four rapid-fire 6-inch; secondary rapid-fire battery, twenty 6-pounders, six 1-pounders, four Gatlings, two field guns. **Torpedo Tubes,** three. **Complement,** 473. **Date,** 1893.



10.—First-class Sea-going Battleship "Iowa."
Displacement, 11,340 tons. **Speed,** 17·1 knots. **Maximum Coal Supply,** 1,795 tons. **Armor:** Belt, 14 inches; deck, 2¾ inches; barbettes, 15 inches; turrets, 15 inches; casements, 6 inches. **Guns:** Main battery, four 12-inch, eight 8-inch, six 4-inch rapid-fire; secondary rapid-fire battery, twenty 6-pounders, four 1-pounders, four Colts, two field guns. **Torpedo Tubes,** four. **Complement,** 505. **Date,** 1896.



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11.—First-class Battleship "Alabama." Also "Wisconsin" and "Illinois."
Displacement, 11,525 tons. **Speed,** 17 knots. **Maximum Coal Supply,** 1,600 tons. **Armor:** Belt, 9½ to 16½ inches; deck, 2¾ inches; barbettes, 15 inches; turrets, 14 inches. **Guns:** Main battery, four 13-inch, fourteen 6-inch rapid-fire; secondary rapid-fire battery, sixteen 6-pounders, four 1-pounders, one Colt, two field guns. **Torpedo Tubes,** four. **Complement,** 489. **Date,** 1898.

NAVIES OF THE WORLD—VIII. UNITED STATES.

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TABLE OF SHIPS BUILT OR BUILDING IN THE UNITED STATES NAVY.

DESCRIPTION OF TYPE.	Number of Ships.	Average Displacement.	Total Displacement.	Average Speed.
Battleships, 10 years or less.	13	11,010	143,130	16 7
Battleships, 10 to 20 years.	....	....	....	....
Battleships, Old or refitted.	....	....	....	....
Totals.....	13	....	143,130	....
Coast Defense Vessels.	11	3,551	40,261	12·2
Armored Cruisers, 9,000 tons and up.	1	....	9,215	21·9
Armored Cruisers, 7,000 to 9,000 tons.	1	....	8,200	21 0
Armored Cruisers, below 7,000 tons.	....	....	....	....
Totals.....	2	...	17,415	....
Protected Cruisers 10,000 tons and up.	....	...	...	...
Protected Cruisers 7,000 to 10,000 tons	2	7,375	14,750	22·9
Protected Cruisers 4,000 to 7,000 tons	6	4,539	27,234	19·6
Cruisers, 2,000 to 4,000 tons.	11	2,974	32,710	18·4
Totals	19	....	74,694	
Small Cruisers and Gunboats.	22	1,237	27,210	16·0
Grand totals.....	67	....	303,070	...

sea-keeping qualities, with the result that in the fine vessels of the "Alabama," "Maine," and "New Jersey" classes we shall possess ships of the line which will be the match of any foreign battleships either for offense, defense, or ability to keep the sea in all weathers.

An excellent feature of our fleet of battleships is the fact that they are all in the class "ten years old or less;" moreover, twelve out of the thirteen are of the first class. The only second-class battleship is the "Texas," of 6,315 tons displacement and 17·8 knots trial speed. She was built at the Norfolk navy yard, the keel being laid in 1889 and the ship going into commission in 1895. Her plans were purchased abroad and subsequently modified before and during the construction of the ship. A strange fatality seemed to attend her earlier history, and the popular prejudice engendered by her many mishaps was not removed until she demonstrated her good fighting qualities during the bombardment of Santiago and the destruction of Cervera's fleet, in both of which she played a prominent part. It was at the close of a single-handed engagement with the Socapa battery that the "Texas" received a shell through her port bow which killed one of her crew and temporarily put the whole 6-pounder forward battery out of action. In the naval battle of a few weeks later, she was severely damaged in her superstructure by a 5·5-inch shell from one of Cervera's cruisers. The "Texas" is an excellent sea boat, thanks to her lofty freeboard; but her arrangement of battery is somewhat out of date. The two 12-inch guns are placed "en echelon" within a central redoubt of 12-inch steel amidships, each gun being carried in a turret protected by 12-inch armor. She has a partial 12-inch belt and a 2-inch protective deck. The intermediate battery consists of six 6-inch guns, and the secondary battery is made up of twelve 6-pounders, six 1-pounders, four Hotchkiss guns, and two Colts. She has two torpedo tubes and carries a complement of 389 officers and men.

The earliest and best known first-class battleships of the navy are the "Oregon," "Indiana," and "Massachusetts." Designed for coast-line service, where they would be within comparatively easy reach of a coaling port, they exhibit a high development of offensive and defensive qualities in the way of guns and armor at the expense of sea-going qualities, as represented by high freeboard, large coal supply, and liberal berthing accommodation for the crew. At the time of their launch they were, for their displacement, the most heavily armed and armored ships afloat; and even today it is only the introduction of the rapid-fire gun that enables more modern battleships to show a greater total energy of gun-fire in a given time. Taking the "Oregon" as being probably the best constructed vessel of the three, if we may judge by actual performances in service, we note that on a displacement of 10,288 tons she combines the following features: A waterline belt amidships of 18-inch Harvey steel, with main barbettes and turrets of 17 and 15-inch and secondary turrets of 6-inch steel. In the two main turrets are four 13-inch guns, and within each of the four secondary turrets is a pair of 8-inch guns carried at a height of 26 feet above the waterline. The intermediate battery also includes four 6-inch rapid-fire guns carried amidships on the main deck. The secondary battery is made up of twenty-nine 6 and 1-pounders and machine guns, carried chiefly upon the boat deck. While this is a tremendous combination of offensive and defensive elements, it is liable to be severely handicapped by the very low freeboard of 12 to 13 feet, which in a seaway would bring the 13-inch and 6-inch guns into uncomfortable proximity to green water. Not that these vessels are for a moment to be spoken of as unseaworthy—the 14,000-mile run of the "Oregon" from the Pacific to the Atlantic settled this question for good—but as compared with ships of 20 to 25 feet freeboard, carrying all their heavy guns at heights even greater than this, the "Oregon" and her class would be at a decided disadvantage considered as gun platforms. A comparison of the accompanying illustrations of the "Oregon" and the "Alabama" will show the great gain secured in the latter ship by the addition of a lofty spar deck extending from the bow aft for two-thirds of the ship's length.

The next battleship to be built after the completion of the "Oregon" class was the "Iowa." As compared with the "Oregon" she is of about 1,000 tons more displacement and 17 knots trial speed, and to her was given a right to the title of "sea-going," by the provision of a spar deck with a freeboard of about 20 feet. The total bunker capacity was increased from 1,597 to 1,795 tons. On the other hand, the main battery was decreased in power by substituting 12-inch for 13-inch guns, while six 4-inch rapid-fire guns took the place of the four 6-inch guns of the "Oregon" class. The "Iowa," like the "Oregon," is now in Pacific waters, and like her she was conspicuous in the operations of the Spanish war.

Following the "Iowa" come the two battleships "Kearsarge" and "Kentucky," the first of which is now undergoing her official trials, and the other rapidly approaching completion at Newport News. As compared with the "Oregon," the "Kearsarge" is about 1,200 tons larger, displacing 11,525 tons, and her contract speed is one knot greater, being 16 as against 15 knots. The "Oregon," however, made 16·8 knots on her trial, and the preliminary trials of the "Kearsarge" indicate that she will probably make 17·5 or 17·75 knots on her official test. In the "Kearsarge" the good features of the "Oregon" are retained and the faults are remedied. The freeboard is a foot or two greater than that of the "Oregon," or say 14 feet—not as much as one could wish, especially in view of the concentration of weight near the bow and stern, due to the double turrets, but still an improvement over the earlier ships; the weight of the intermediate battery of 8-inch guns has been reduced about two-thirds by throwing out four guns and two turrets altogether and mounting the other two turrets upon the roof of the 13-inch gun turrets; and the intermediate battery has been strengthened by the substitution of fourteen 5 inch rapid-fire guns, which are carried behind a 6-inch armored casemate amidships on the main deck.

The double-turret is an innovation as daring as it is novel, and it has been a fruitful source of discussion among naval officers and architects. That the device is economical in weights may be judged from the fact that the all-round fire of the four 8-inch guns is as great as that of the eight guns on the "Oregon," the latter ship never being able to fire its 8-inch guns dead ahead or astern because of interference with the 13-inch guns. Moreover, the turning machinery and ammunition hoists are so superbly protected by the 15-inch armor of the 13-inch turrets that their chances of being disabled are extremely slight. On the other hand it must be admitted that a well-directed shell might disable all four guns of a double turret at once, and the crowding of four sets of hoisting gear so closely together is undesirable and might lead to serious delay in all four guns of the system. Only the test of service can determine the actual merits of the device. The principal particulars of the armor, batteries, etc., of this fine ship will be found below the half-tone engraving of the vessel. Special attention should be drawn to the fact that the waterline armor is carried right up to the stern, being four inches thick at this point.

Following the "Kearsarge" and "Kentucky" come the three sea-going battleships of the "Alabama" class. The "Alabama" was launched in 1898 and has recently undergone a builder's trial. She is of the same displacement, coal capacity and contract speed as the "Kearsarge," but there the likeness ceases. In the first place a lofty spar deck with a freeboard of about 20 feet as in the "Iowa" extends from the bow for two-thirds of the length, and above this is carried the forward pair of 13-inch guns at an elevation of about 24 feet above the water. This deck not only improves the sea-going qualities, but it also affords splendid berthing accommodations for the crew. The 8-inch gun has disappeared altogether and the intermediate battery is made up of fourteen 6-inch rapid-fire guns, with the result that the total energy of gun-fire per minute is greatly increased though the destructiveness of the 6-inch shell is far less than that of the 8-inch. The 6-inch rapid-fire battery is distributed on two decks. Eight of these guns are carried on the main deck within a central citadel protected with 6 inches of steel, two are mounted forward in 6-inch casemates, one on each bow, and two amidships in casemates on each beam on the spar deck. The after pair of 13-inch guns is carried on the main deck. The armor is 16½ inches on the belt, 5½ or 6 inches on the sides above the belt, 14 inches on the turrets and 15 inches on the barbettes. The contract speed is 16 knots and will probably reach 17 knots or more on the official trial.

The "Alabama" must always be a notable battleship for the reason that she is the first of a type which seems likely to become permanent. The type has been reached by a process of selection; and it represents the embodiment of the experience of our own and other warship builders the world over. The later ships, of the "Maine" and "New Jersey" classes, are simply improved "Alabamas," incorporating as they do the later ideas as to speed, armor, and batteries, with such increase in displacement as is rendered necessary.

Thus the plans of the "Maine," which originally called for a 16-knot ship, have been changed to admit of her making the more modern speed of 18 knots. Twenty feet were added to the length, and 1,000 tons to the displacement. This enlargement, together with the reduction in thickness of the armor, due to its higher resisting qualities, and the saving in weight due to the substitution of the 12-inch for the 13-inch gun, have enabled the coal capacity to be increased and a more liberal amount of stores to be carried. The bunker capacity is 2,000 tons, and two additional 6-inch guns appear in the intermediate battery, making sixteen of this type in all. The three vessels of the "New Jersey" class, authorized last Congress, and purposely "held up" as to their construction by the tactics of a few politicians who succeeded in imposing impossible restrictions as to armor, will conform in general to the "Alabama" and the "Maine," but will contain some new features of interest, which were illustrated in our issue of September 9, 1899. As they are not yet under construction these ships are not included in the table of the navy above given. The plans have not been finally decided upon, but the particulars will probably be as follows: Displacement, 13,500 tons; speed, 18 knots; coal supply, 2,000 tons. Armor: belt, 9 to 4 inches; central casemate, 6 inches; 14-pounder battery, 3 inches; main turrets, 12 inches; 8-inch turrets, 6 inches. Battery: Four 12-inch, four 8-inch, twelve 6-inch rapid-fire; sixteen 3-inch rapid-fire, and sixteen 3-pounders, besides many smaller guns. The personnel throughout the navy will welcome the return of the 8-inch gun. The four guns of this caliber will be carried in turrets one on each beam amidships. All the guns of these ships and the "Maine" class will be of the new, long-caliber smokeless-powder type, with improved breech mechanism, and the energy and rapidity of fire will be increased proportionately.

The adjoining table, for the particulars of which we are indebted to the courtesy of Rear-Admiral O'Neil, shows what an increase of energy and decrease of weight has been effected by the improvements which have taken place during the past decade in the ballistics of our naval guns. Thus, we find that the use of smaller calibers, higher velocities, and rapid-fire breech mechanism has not only raised the total muzzle energy of the guns of the main battery in one minute's firing from 137,015 foot-tons in the "Oregon" to 337,716 foot-tons in the "New Jersey," but the proportion of the weight of these guns to the displacement has been reduced from 3·60 per cent in the former to 2·78 per cent in the latter vessel.

COMPARISON OF MAIN BATTERIES.

1. Name.	2. Normal Displacement in Tons.	3. Description of Guns of Main Battery.	4. Total Weight of Guns of Main Battery in Tons.	5. Muzzle Energy of Guns of Main Battery in One Minute in Foot Tons.	6. Weight of Metal Thrown in One Minute by Guns of Main Battery in Pounds.	7. Proportion of Weight of Guns of Main Battery to the Displacement.
"Oregon" and Class.....	10,288	4 13-in. of 35 cals. 8 8-in. of 35 cals. 4 6-in. of 40 cals.	371	137,016	3,458	3·60
"Iowa"	11,340	4 12-in. of 35 cals. 8 8-in. of 35 cals. 6 4-in. of 40 cals.	294	111,582	3,119	2·59
"Kearsarge" and Class...	11,525	4 13-in. of 35 cals. 4 8-in. of 35 cals. 14 5-in. of 40 cals.	338	200,984	4,558	2·93
"Alabama" and Class.	11,525	4 13-in. of 35 cals. 14 6-in. of 40 cals.	326	235,764	5,458	2·82
"Maine" and Class.	12,500	4 12 in. of 40 cals. 16 6-in. of 50 cals.	336	357,852	5,929	2·68
"New Jersey" and Class..	13,500	4 12-in. of 40 cals. 4 8-in. of 45 cals. 12 6-in. of 50 cals.	376	337,716	5,229	2·78

MONITORS.—The monitor is a legacy of the civil war, and the fact that as recently as last year Congress authorized the construction of four of this archaic type of vessel proves how largely, even in such a weighty matter as warship construction, a legislative body may be swayed by sentiment and tradition. Including the new monitors now under construction, we have a dozen of these home-keeping craft. With these, as being more like them than it is like any other ships in the

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navy, we have included in our table the armored ram "Katahdin." Four of the monitors are of the "Miantonomoh" type, and one, the "Puritan," is an enlarged "Miantonomoh." Their keels were laid as long ago as 1874, and after ten years had elapsed only the iron hulls and old-fashioned engines were completed. Subsequently to 1875 they were again taken in hand, modern armor being placed in position, and modern breech-loading rifles mounted in the turrets. The "Miantonomoh," "Monadnock," and "Terror," are sister ships of 3,990 tons and 10·5 knots speed. The armament consists of four 10-inch breech-loading rifles carried in two turrets, besides two 4-inch rapid-fire guns and eight smaller rapid-fire guns and machine guns carried on the superstructure. The side armor is 9 inches thick amidships and 5 inches at the ends. The barbettes carry 11½-inch and the turrets 7½-inch armor. The "Puritan" is a much larger vessel than these, with a displacement of 6,060 tons and a speed of 12·4 knots. The full particulars are given below the accompanying engraving of the vessel. The "Monterey," which, in common with the "Monadnock," is now in the Philippines, the two vessels having crossed the Pacific under their own steam, is a modern vessel in all particulars. She is of 4,084 tons displacement, 13·6 knots speed, carries a 13-inch belt and 8 inches on the turrets, and carries a main armament of two 12-inch and two 10-inch guns. The four monitors of the "Arkansas" class, which are now under construction, are considerably smaller than the vessels above mentioned, and must necessarily be confined strictly to harbor defense. On a displacement of 2,755 tons, they will have a speed of 12 knots and will carry two modern 12-inch guns in a barbette turret armored with 10 inches and 12 inches of steel. There will be a battery of four 4-inch guns carried at the four angles of the superstructure. The "harbor-defense ram" "Katahdin," as she is officially known, was built purely for ramming. She has an armored turtleback deck, varying from 3 to 6 inches in thickness, and when her total weight of 2,155 tons is being driven against the enemy at a speed of 16 knots she is supposed to be a very formidable weapon. Among the officers of the navy, however, she has always been an unpopular craft, and it is not likely that her design will ever be repeated.

ARMORED CRUISERS.—In the class of armored cruisers we have at present only two vessels, the "New York" and the "Brooklyn," although three powerful ships of 12,000 tons were authorized by the last Congress. Both the "New York" and the "Brooklyn" were brought into special prominence in the late war. The "New York" was the flagship of Admiral Sampson, and as such she was a conspicuous vessel in the blockade of Havana, the bombardments of San Juan and the Santiago forts and the blockade of Santiago Harbor. The "Brooklyn" as flagship for Admiral Schley was first identified with the flying squadron at Hampton Roads and later became famous as the vessel picked out by the Spaniards for their concentrated fire when they made their sortie from Santiago, and the leading ship in the long pursuit of the "Cristobal Colon." The full particulars of these vessels are given beneath their respective engravings. Before passing on to a consideration of the protected-cruiser class, attention should be drawn to the fact that it is in the armored-cruiser class that we ought to make the first and largest addition to our navy. These vessels combine the mobility of the cruiser with much of the powers of attack and defense of the battleships. With a sufficient fleet of armored cruisers afloat, we would be prepared to meet a sudden concentration of armored ships in any part of our widely extended possessions.

PROTECTED CRUISERS.—Our earliest efforts in the creation of a new navy were confined entirely to the construction of protected cruisers of high speed and powerful batteries; and though of late years we have somewhat neglected this class and our attention has been directed more to the construction of battleships, gunboats, and torpedo boats, we have a fine fleet of nineteen effective ships of the protected class, ranging in displacement from 2,000 up to 7,375 tons. The largest and fastest are the twin ships "Minneapolis" and "Columbia," of about 23 knots trial speed and 7,375 tons displacement. These were originally built as commerce destroyers, a work for which their speed and enormous cruising radius render them exceptionally qualified. Of ships between 4,000 and 7,000 tons displacement we have six: the "Chicago," 4,500 tons and 18 knots; the "Newark," 4,098 tons and 19 knots; the "Baltimore," 4,413 tons and 20·1 knots; the "Philadelphia," 4,324 tons and 19·7 knots; the "San Francisco," 4,098 tons and 19·5 knots; and the famous "Olympia," Admiral Dewey's flagship at Manila, 5,870 tons and 21·8 knots. The "Chicago," "Baltimore," and "Olympia" carry, each, four 8-inch guns as their main battery, the intermediate battery consisting in the "Chicago" of fourteen and in the "Olympia" of ten 5-inch rapid-fire guns; in the "Baltimore" the intermediate battery consists of six 6 inch guns. The three other vessels carry a main battery of twelve 6-inch guns. All of these ships have complete protective decks.

By far the most effective of them all is the "Olympia," for in addition to her greater displacement, she has the advantage of about 2 knots greater speed; moreover, she carries her main battery in turrets, and her protective deck is heavier, reaching a thickness of 4¾ inches on the slopes. A finer vessel for her size it would be difficult to find, and because of its historic associations the name "Olympia" will take its place as one of the most famous in the annals of the United States navy.

There are eleven cruisers in the navy of from 2,000 to 4,000 tons displacement. These are the "Atlanta" and "Boston," 3,000 tons and 18·2 knots, and the "Charleston," 3,700 tons and 18·2 knots, each carrying two 8-inch and six 6-inch breech-loading rifles; the "Cincinnati" and "Raleigh," 3,213 tons and 19 knots, armed with one 6-inch breech-loading rifle and ten 5-inch rapid-fire guns; the "Detroit," "Marblehead," and "Montgomery," unprotected cruisers of 2,089 tons and 18·5 knots, carrying ten 5-inch rapid-fire guns; and the recently acquired "New Orleans" and "Albany," of 3,600 tons and 21 knots, carrying six 6-inch and four 4·7-inch rapid-fire guns. The latest and most effective of these ships are the two last named, and it is sincerely to be hoped that the revised plans for the six new 3,500-ton cruisers will be based upon the admirable design embodied in these two boats.

SMALL CRUISERS AND GUNBOATS.—In this class are included twenty-two vessels, of an average displacement of 1,237 tons and average speed of 16 knots. The most important of these are the three gunboats "Bennington," "Yorktown," and "Concord," the last of which did excellent work in the battle of Manila Bay. These vessels are of 1,710 tons displacement and 16 to 17 knots speed. The "Concord" and "Bennington" mount six 6-inch breech-loading rifles in the main battery, and the "Yorktown" has been re-armed with six 5-inch rapid-fire guns. Next to these in size are the light-draught gunboats "Helena," "Nashville," and "Wilmington," of 1,362 tons and 15 to 16 knots, carrying each eight 4-inch rapid-fire guns. They were designed for shoal waters and river service, and are admirable vessels for the purpose. The "Castine" and the "Machias" are gunboats of 1,117 tons and 16 knots, armed with eight 4-inch rapid-firers. The "Bancroft," 839 tons and 14·4 knots, carries four 4-inch rapid-firers, and the little "Petrel," 892 tons and 11·8 knots, will ever be memorable as having formed one of the Manila fleet on the 1st of May, 1898, where, at the close of the fight, she was sent into the shoaler waters of Cavité to complete the destruction of the Spanish fleet. She carries four 6-inch breech-loading rifles. In the unarmored composite gunboats of the "Annapolis" and "Marietta" type we have six useful vessels of 1,000 tons displacement and speeds of from 12 to 13 knots. Each carries a main battery of six 4-inch rapid-fire guns. Other vessels in this class are the "Topeka," 1,700 tons and 16 knots, carrying eight 4-inch rapid-fire guns, a re-armed iron cruiser purchased during the war; the training ship "Chesapeake," 1,175 tons, propelled entirely by sail power; the steel dispatch boat "Dolphin," 915 tons and 15·5 knots, carrying three 4-inch rapid-fire guns, and the "dynamite gunboat" (as she is called) "Vesuvius," armed with three 15-inch dynamite guns.

This brings us to the close of our necessarily brief review of the ships of the modern American navy and to the close of our series on the navies of the world. Comparing our relative strength now with what it was fifteen or sixteen years ago, when we entered in earnest upon the stupendous task of creating from the ground up, as it were, an entirely new navy, we have just cause for congratulation. At that time the United States had no place upon the list of modern navies, or if it had, it was that of a poor sixth; to-day it not only ranks as one of the great navies of the world, but it has outgrown in strength the fleets of Italy and Germany, and ranks easily as fourth in power and efficiency. As to the personnel, it is unnecessary to do more than point to the records of the Spanish war, where both officers and men have shown that dash and good shooting are to-day, as of old, the distinguishing characteristics of our navy.

Photographed by the American Mutoscope and Biograph Company.

ADMIRAL DEWEY ON BOARD THE "OLYMPIA" AT VILLEFRANCHE.

Lithium Minerals and Their Utilization.

Probably it is not generally known to manufacturing chemists in the United States that this country has vast resources in lithium mineral which have never been exploited. Lithium is classed as one of the rare elements, and is indeed rare in its metallic form, but its compounds are not rare in occurrence or in commerce. We do not know what their usefulness might be if their supply were large and cheap, but at present the use of lithium salts, especially the carbonate, is chiefly in the preparation of lithia water, which is used extensively for medicinal purposes in such diseases as rheumatism, due largely to an excess of uric acid in the system. There are some natural lithia waters, but a good deal of what is sold as such are artificial. The consumption of lithium carbonate for this purpose in the United States is variously estimated at from 40,000 to 200,000 pounds per annum, all of which is obtained from Germany. The average value of the salt at New York in 1898 was $4.22 per pound. Consequently, it is evident that there is a good business in sight for some one who will undertake its manufacture in this country, although it should not be expected that the price would keep up if the supply were increased largely.—Engineering and Mining Journal.

The Current Supplement.

The current SUPPLEMENT, No. 1239, has many articles which will interest our readers. The front page is taken up by a fine engraving of the design for the National Pavilion at the Paris Exposition. Plans of the Exposition grounds and of Paris showing the methods of communication are also given. "The Automobile Club of France" is an article by Francis P. Mann. "The Prolongation of the Orleans Railway" describes an important engineering work. "In the Philippines" describes some of the interesting scenes which are taking place in our new territory. "How Clay Pipes are Made" describes a novel industry in an attractive manner. "Prehistoric Man in America" is an abstract of an address delivered by the American Association for the Advancement of Science by Dr. F. W. Putnam. "The Beginnings of the Science of Prehistoric Anthropology" is by Prof. Thomas Wilson. "The Present Position of the Investigation of the Malarial Parasite" is a timely article upon a subject which is interesting the scientific world. "The History of the Umbrella" is a curious article.

Contents.

(Illustrated articles are marked with an asterisk.)

American enterprise in Siam.... 214
Arms and the man.... 210
Automobile news.... 214
Bearing for bicycles*.... 213
Blue rays over Mt. Blanc.... 213
Book notes.... 220
Dewey, Admiral*.... 219
Dewey's fleet*.... 209, 216
Electrical notes.... 215
Electric lighting at Covent Garden Theater.... 211
Electromobile, Chapman*.... 213
Engineering notes.... 215
Engine, rotary*.... 213
Export Exposition, National*.... 212
Exposition, National Export.... 210
Heavens in October.... 211
Ink well, suspended*.... 214
Inventions recently patented.... 220
Lead arsenate, manufacture of.... 211
Lithia minerals.... 219
Marconi, arrival of.... 211
Microbes, telephone.... 214
Museum of Royal College of Surgeons.... 213
Navies of the world*.... 209, 216
Notes and queries.... 220
Pistol, Mauser*.... 210
Railroad, Euphrates Valley.... 210
Russian weights and measures.... 213
Science notes.... 215
Sulphur Island.... 214
Thermodynamics of the human machine.... 214

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RECENTLY PATENTED INVENTIONS.

Bicycle-Appliances.

SHAFT-BEARING.—Byron E. Foss, Chicago, Ill. This bearing for crank-shafts comprises a casing open at one side and adjustable in diameter. Bearing rings are normally seated in the ends of the casing and are longitudinally open at one side. On the shaft are bearing-collars; and on opposite sides of the bearing-collars retaining-collars have their edges turned inwardly. These retaining-collars form the side walls of raceways in which balls roll. End caps for the casing also have raceways, one wall of each being turned toward the other. Balls also roll in the latter raceways.

REST.—Alexander G. Shields, L'Anse, Mich. The bicycle-rest comprises members adapted for attachment to a bicycle-frame, one of the members having outwardly-extending lugs with which legs are pivotally connected. Downwardly and outwardly inclined blocks between adjacent lugs govern the angle of the legs relatively to the bicycle. A member adapted to be secured to the bicycle-frame has clips to receive the legs when folded.

Railway-Contrivances.

SWITCH.—Charles Troup, Watseka, Ill. The present invention is an improvement upon an operative mechanism for pivoted switch-rails, patented by the same inventor. With the fixed and switch rails a tripping device is connected, adapted to be acted on by car-wheels. A rod extends alongside the track and is connected with automatic mechanism for shifting the switch-rails. When a locomotive or car passes over the siding, traction is applied to the rod and hence to the automatic mechanism, whereby the switch-rails are thrown from their normal position into position for the siding.

ADJUSTABLE SEAT.—Thomas B. Mason, Trenton, N. J. The object of the invention is to provide a seat for motormen. The seat consists of a standard universally mounted so as to have free movement in any direction and provided with a bicycle-saddle secured to a tubular post resting on a spring surrounding the standard so that there will be no jar. When it is necessary for the motorman to rise, the saddle will be carried up with him by the expansion of the spring. The saddle is adjustably secured in position by a clamp.

COLLAPSIBLE SEAT AND HEAD-REST.—Henry S. Kidd and Michael H. Depue, Washington, N. J. This invention provides a seat and a back for use on railway-car seats, so as to provide a support for the head of a traveler. The seat and back are furnished with a pillow upon which the head may be reclined. The improved chair may be very compactly folded and placed in the casing or cover, so that the entire device may be conveniently carried in a valise or hand-satchel. The chair can also be used on the sea-shore.

Miscellaneous Inventions.

ELECTROMEDICAL APPLIANCE.—John E. Freeman, Beard, Ky. The appliance has a belt with a non conducting front and back portion. Electrodes are located on the outside of the belt, and have fastenings extending into the space between the front and back portions of the belt. A wire is located between these portions of the belt and electrically connects the electrodes. The fastenings of one electrode extend through the belt to the outside in order to form a means for connecting the belt with a source of electricity.

ARTIFICIAL BAIT.—Edward T. Dukes, Quitman, Ga. This inventor has provided an improvement in artificial bait which, when drawn through the water, will move like a minnow. The bait has a body composed of a thin plate of aluminium resembling a minnow and twisted spirally to insure its rapid rotation when drawn quickly through the water. Fin-like projections are provided to aid as propellers in securing the desired rotation. The hooks are arranged in pairs on each side of the axial line and are so attached as to offer the least resistance to the rotation of the bait-body and to be readily removed and replaced.

HYDRAULIC-DREDGE. — Peter Kirk, Kirkland, Wash. This machine for dredging gold-bearing sands and gravel covered by water comprises a vertical rotary mast and two horizontal supporting arms. A vertical hydraulic pipe is adjustably mounted on the upper arm and passes through the lower arm. The pipe has inner and outer tubes with a boring-head at its lower end. On the lower arm a turning mechanism for the hydraulic pipe is mounted. At the upper end of the hydraulic pipe is a receiver provided with pipes for carrying away the sand and gravel. There are no valves and working parts; and the machine carries the full power of suction and force to any depth required.

SASH-LOCK.—George E. and Lowell Parker, Newark, N. J. The present invention provides an improvement in locks for securing upper and lower sashes together, so that they cannot be raised or lowered without first freeing the lock. The locking mechanism is inclosed within a casing having bearings for two locking-bolts which cross each other at right angles. One of the bolts is adapted to enter a recess or hole within one of the sashes and the other bolt is adapted to enter recesses or holes in the window-casing. These two bolts are each provided with a central yoke or crank, which cranks mutually engage with each other, so that one bolt may be reciprocated by turning the other.

DETACHABLE CONNECTION FOR ELECTRIC FIXTURES. — Stacy G. Read, Bridgeport, Conn. On the stage it is often a matter of importance quickly to change the incandescent lamps, in which operation the usual screw and socket are too inconvenient. In the present invention a fixed base is used having two parallel grooves. Two metal plates connected with the feed-wires are secured to the face of the base outside the grooves and project over the major part of their width. A socket-base has two projecting L-shaped arms in electrical connection with the conductors of the fixture, which arms enter the grooves and engage the plates so that the fixture can be quickly slid into and out of place.

HARNESS-BUCKLE.—James A. Gavitt, Waitsburg, Wash. The harness-buckle provided by this inventor is especially adapted for use as a trace-buckle, but can be used equally well upon light or heavy harness. The construction is such that the buckle can be cheaply manufactured and can be readily manipulated to effect a connection or disconnection between two straps. The buckle is entirely free from springs and can be operated as readily with gloved as with ungloved hands.

JACK.—Charles W. Doane, West Lake, La. This jack comprises a body portion in which a lifting-screw is adjustable. A ratchet mechanism operates the lifting-screw, which mechanism includes a lever provided at its outer end with spaced lugs and with a block arranged centrally. An extension handle is adapted to be received between the lugs and is provided with fingers ranged to embrace the block. The jack can be operated upwardly or downwardly, and can be used for pushing heavy weights along a floor or for lifting a telegraph-post.

SIGNAL-LANTERN.—Thomas M. Crepar, Swan River, Minn. To provide a lantern for use on railroads, vessels, docks, and the like is the purpose of this invention. The lantern comprises a burner and two globes of different colors, one of the globes being fixed relatively to the burner and the other globe being movable into an active position around the burner for the lantern to display a danger-signal, or into an inactive position for the lantern to display a safety-signal.

BOAT FOR LAND OR WATER.—Jean P. Bouleseque, Manhattan, New York city. This invention provides a combination boat and wagon. The hull of the vessel has a driving-shaft, the ends of which are adapted to receive supporting-wheels. A truck is detachably connected with the forward portion of the boat and is provided with a steering device. A propeller-shaft is adjustably geared with the drive-shaft; and the drive-shaft is, in turn, connected with a motor. Storage-chambers are provided for power. The motive agent used is compressed air.

CONCENTRATOR.—Joseph Woodham, Longbeach, Wash. The invention is an improvement in concentrators adapted particularly for use in connection with placer deposits. The concentrator consists essentially of a rocking, curved trough having angularly-shaped riffles extending across its bottom and stirring projections or pins projecting upwardly from its bottom. The swinging motion will cause the pins to pass back and forth through the water, while the water, by reason of its inertia, will be at rest. Consequently, the material is continually stirred, so that the gold may readily settle to the bottom and thus be collected beneath the riffles.

CARBONATING APPARATUS.—John Walter, Savanna, Ill. The apparatus is more especially designed for carbonating mineral waters and other liquids, and is composed of a receptacle provided with an inlet for the liquid to be carbonated, in which receptacle a float is located which controls a liquid-supply valve. A pipe extends through the float and is provided with openings in the upper and lower portion of the float, to fill the latter with gas and drain the liquid therefrom.

NECKTIE.—Gustave Selowsky, Manhattan, New York city. The tip of the collar-band of a necktie is so made that it can be utilized entirely for engagement with the fastening-pin of the tie. The band is made shorter than usual, thereby economizing in material, but is nevertheless so arranged that it can be applied to a greater range of variously-sized collars than formerly.

DEVICE FOR MAKING CIGARETTES.—Joseph B. Popenhagen, Chicago, Ill. This invention provides a portable device for making cigarettes, which device can be comfortably carried in the vest-pocket and can be used in direct connection with a tobacco-pouch. The device may also be temporarily attached to the pocket of a garment, so that the tobacco may be drawn from its pouch, packed in a shaping-section of the device, and passed from the section into a wrapper of the usual type prepared to receive the packed material.

PUZZLE.—John J. O'Brien, Manhattan, New York city. The puzzle comprises a box and a die; the box being so arranged that after inserting the die, it will be difficult to discharge the die from the box. Only a person familiar with the puzzle can thus displace the die.

SMELTING-FURNACE.—Joseph V. Otten, Iola, Kan. In the general method of using natural gas for fuel in zinc-smelting, there is an enormous waste and considerable expense. The present invention reduces the cost of constructing and operating smelting-furnaces by dispensing with the use of a blower-plant, the initial pressure of the natural gas (350 pounds per square inch) being found sufficient to draw in all the air necessary through properly-constructed burners. The inventor also produces a soft, glowing, flame heat in the retort chamber and avoids all blowpipe action. The flue-openings are so arranged that the heated gases pass between and around each bank of retorts before passing out at the flue-opening, which is opposite the heat-side of the retorts.

THEATRICAL APPLIANCE.—Frederic S. Lotto, Manhattan, New York city. A patent has been granted to this inventor for an appliance which, when all its parts are assembled, will represent a piano. By pulling upon cords or ropes, the casing will fall apart, several loosely-hanging strings will be disclosed, and the piano will apparently be completely demolished; nevertheless a perfect instrument arranged in the case will remain intact.

GATE-LATCH.—William A. Jeffers, Mulberry, Ark. In a casing having a slot in its wall, a slide is mounted having shoulders working in the slot to limit the slide's movement. Keeper-fingers project outwardly from the slide, and a latch is mounted on one of the fingers and adapted to swing against the other. A pin is movably mounted in the casing and is adapted to engage any one of a series of openings in the slide so as to hold the slide adjustable. The latch can be conveniently adjusted to suit the variations in the position of the gate, and can hence be arranged to compensate for the sagging of the gate.

DEVICE FOR SEALING PACKAGES.—Henry M. Humphrey, Plainfield, N. J. The paraffin or wax paper package has its upper edges brought together and bent upon themselves to form a fold. A sealing-plate is provided, having a flange between which and the body of the plate the fold is received and upon which fold the plate is firmly and immovably clamped, whereby a package hermetically sealed will be produced which can be opened only by cutting or tearing off the material of which it is made.

SASH-CORD FASTENER. — Richard Bohrisch, Chicago, Ill. The fastener has two cheek-pieces adapted to lie on each side of the sash-cord and furnished with bolt-holes through which a fastening-bolt may be passed. A finger secured to each cheek-piece is adapted to engage with the sash. A yoke joins the cheek-pieces with each other. By means of this fastener the cords may be disconnected so that the sash can be removed from the frame.

LACING. — Peleg J. Congdon, Providence, R. I. This lacing is applicable to shoes and corsets, and is provided with a stiffener in the form of a split tube located at the tip of the lacing, the split clamping a side of the lacing, and giving a neat appearance to the whole.

Designs.

LAP-ROBE.—Mrs. Maggie B. Showen, Macon, Mo. The lap-robe is designed to rest in use upon the seat of a vehicle, to extend down below the front of the seat to the bed of the carriage, then forward. A returned portion extends up sufficiently high to protect the lap of the rider, and is provided at its sides with flaps which protect the rider at the opposite sides of the vehicles.

RATCHET-BAR FOR WINDOW-FASTENERS.—William L. and Charles T. Fields, Cedar Bluff, Va. One face of the ratchet-bar is composed of a series of gradually-inclined and abruptly-ending surfaces which form shoulders adapted to receive a latch on the sash so as to hold the latter at various elevations. Below the series of inclined surfaces is a flat protuberance with the lower edge of which the latch is adapted to engage when the sash is closed so as to hold the sash in such position. The bar is also provided with a scalloped edge.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

LEXIKON DER METALL-TECHNIK. Redigirt von Dr. Josef Bersch. Vienna: A. Hartleben. 1899. 6–10 installments. Price, paper, 70 cents each.

DIE MODERNE CHEMIE. Eine Schilderung der Chemischen Grossindustrie. Von Dr. Wilhelm Bersch. Vienna: A. Hartleben. 1899. 6–10 installments. Price, paper, 70 cents each.

With the tenth installment both of these works have now been half completed. At the appearance of the very first parts it was evident that these books would be exceptionally broad in scope and exhaustive in treatment. The first halves as a whole certainly deserve the unstinted praise which they have received, and the remaining portions, we trust, will meet with the same favor.

MODERN PLUMBING, STEAM AND HOT WATER HEATING. By James J. Lawler. New York: Chiswick Publishing Company, 18 Rose Street. 1899. 8vo. Pp. 397, 300 illustrations. Price $5.

The author has had many years of practical contact with mechanics in the construction of steam and hot water plants and plumbing work, and he has very wisely decided to elucidate his text with a large number of diagrams reproduced on a large scale. The result has been a work which can be used to advantage by every plumber even though he may not be a sanitary engineer. It is specially adapted for the plumber, the heating engineer, the builder and the architect, and all of them are sure to find something which will prove of value to them.

HEAT AND HEAT ENGINES. A Study of the Principles Which Underlie the Mechanical Engineering of a Power Plant. By Frederick Remsen Hutton. New York: John Wiley & Sons. London: Chapman & Hall, Limited. 1899. Pp. xxi, 553. Price $5.

This volume supplements "The Mechanical Engineering of Power Plants" by the same author. In the present volume he deals with the question of design of apparatus and treats the subject in a thorough and scientific manner. Probably no one is better fitted than Prof. Hutton to deal with the subject on which even great authorities have failed. It is a most admirable book which we can confidently recommend to all except beginners who have some difficulty in understanding mathematics, but as a reference book for them it will be invaluable.

LANDSCAPE GARDENING. Treatise on the General Principles Governing Out-Door Art. With Sundry Suggestions for Their Application in the Commoner Problems of Gardening. By F. A. Waugh. New York: Orange Judd Company. 1899. Illustrated. Pp. viii, 152. Price 50 cents.

An excellent little book on the subject has been needed for some time. There are wonderful opportunities open to all architects and gardeners and we regret to say that in the majority of cases these opportunities are lost, because people do not know how to analyze or understand a landscape. The perusal of this book while it will not make landscape gardeners, will put the reader in the possession of the broad facts which underlie the science and will thus enable him intelligently to lay out small private grounds.

Public Improvements is the title of a new bi-monthly periodical published by the Florence Publishing Company, of 21 Park Row, New York city. It is an excellent paper devoted to municipal engineering. It contains a number of very readable articles and is not too technical. The subscription price is $2 per annum.

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HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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Minerals sent for examination should be distinctly marked or labeled.

(7722) J. R. E. asks: 1. Is there any definite relation between the length of a static spark and the voltage? A. There is a relation between the voltage and length of spark given across an air gap, but not a simple relation. You will find something on this point in Thompson's "Electricity and Magnetism," price $1.40 by mail. Also an article in the "Proceedings of the American Institute of Electrical Engineers," vol. x, giving voltage and spark length. 2. Do the uranium salts fluoresce to any extent under influence of the X rays? A. The simple salts of uranium do not fluoresce strongly in Roentgen rays. 3. Would it be possible, by suspending a suitable collector at a height of 500 or 1,000 feet, which is connected to a terminal and Leyden jar, and to another terminal and Leyden jar connecting a ground wire, to obtain a static discharge? A. Certainly, if the air was charged to any extent. At any time there would be considerable electrification of the balls. You only describe a modification of Franklin's experiment with the kite, an experiment which we should advise you not to repeat during a thunderstorm.

(7723) W. V. asks: If an ounce of iron and a ton of iron should be dropped from the same height at the same time, would they both reach the ground at the same time? A. This matter was put to the test of experiment by Galileo at the Leaning Tower of Pisa early in the 17th century, with two balls of lead, weighing one and ten pounds respectively. The followers of Aristotle had taught for centuries that the balls would fall in proportion to their weights, the heavier one falling the faster. Galileo pointed out the fact that the lighter one would reach the ground first because the air would resist the fall of the larger one more than it would that of the smaller. He had previously demonstrated the law of falling bodies that the velocity under the action of gravity is independent of the mass of the body. Experiment confirmed his position. The small ball reached the earth first. In a vacuum all bodies fall with the same velocity, through any distance. As a practical statement, it may be taken as true that small dense bodies will conform to the theoretical laws, falling any distance less than 200 feet, in the atmosphere. But with an ounce and a ton there would be a perceptible difference. The ounce ball would fall the faster. Facts like this are now-a-days demonstrated by even elementary students in almost every class in physics in the country.

(7724) H. M. G. asks how to make an ever-ready pad for rubber stamps. A. The following is said to be a cushion that will give color permanently. It consists of a box filled with an elastic composition, saturated with a suitable color. The cushion fulfills its purpose for years without being renewed, always contains sufficient moisture, which is drawn from the atmosphere, and continues to act as a color stamp cushion so long as a remnant of the mass or composition remains in the box or receptacle. This cushion or pad is too soft to be self-supporting, but should be held in a low, flat pan, and have a permanent cloth cover. The composition consists preferably of 1 part gelatine, 1 part water, 6 parts glycerine, and 6 parts coloring matter. A suitable black color can be made from the following materials: 1 part gelatine glue, 3 parts lampblack, aniline

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black, or a suitable quantity of logwood extract, 10 parts of glycerine, part absolute alcohol, 2 parts water, 1 part Venetian soap, ½ part salicylic acid. For red, blue, or violet, 1 part gelatine glue, 2 parts aniline of desired color, 1 part absolute alcohol, 10 parts glycerine, 1 part Venetian soap, and ½ part salicylic acid. The following are two additional receipts used for this purpose: Mix and dissolve 2 to 4 drachms aniline violet, 15 ounces alcohol, 15 ounces glycerine. The solution is poured on the cushion and rubbed in with a brush. The general method of preparing the pad is to swell the gelatine with cold water, then boil and add the glycerine, etc. 2. Aniline violet, 90 grains; boiling rain water, 1 ounce; to which is added a little glycerine and a small quantity of molasses. The quantities of last two ingredients will vary with the season, but half a teaspoonful will be ample for the quantities of violet and water specified.

(7725) A. C. B. asks: Is there a simple method of making oxygen? A. Oxygen may be obtained on a small scale very readily by simply heating in a close retort a mixture of 4 parts chlorate of potash and 1 part black oxide of manganese. If large quantities are desired, the continuous process of T. Du Motay may be employed. The principle of this process resides in the fact that the manganates and permanganates of potash, soda and baryta, the ferrates and chromates of the same bases, and in general all metallic oxides and acids which will form, with potash, soda, or baryta, binary compounds capable of superoxidizing, possess the property of yielding their oxygen at a more or less elevated temperature, when they are submitted to the action of a current of steam. These bodies, thus deoxidized, also possess the property of reoxidizing themselves when they are exposed to a temperature more or less great. The atmosphere is therefore the constant source from which the oxyden is derived. The mode of operation is the following: One of the binary compounds just enumerated is placed in a distilling vessel, whether at the maximum or minimum state of oxidation. If the compound is in the latter condition, it is oxidized by means of a current of air mechanically drawn over it; if at the former stage, it is deoxidized by means of a current of steam. The oxygen and steam, on issuing from the mouth of the retort, pass together into a condenser, where the steam is separated by condensation, while the oxygen passes over into a gas holder, and is there collected. When all the utilizable oxygen has been disengaged by the steaming process, the action of superoxidation by means of the air current is recommenced. By this alternate process the oxygen is generated as long as may be required.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending

SEPTEMBER 19, 1899,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Adding and subtracting machine, Ball & Riggs... 633,374
Alarm. See Burglar alarm.
Automotor horse, C. Rousset... 633,369
Awning for windows or doors, detachable, W. S. Armstrong... 633,110
Axle, divided car, S. L. Denney... 633,183
Axles and journals, means for reducing friction of, W. J. Brewer... 633,116
Back pedaling brake, Rogers & Patrick (reissue). 11,773
Baling press, Gunlock & Thwing... 633,513
Baling press, J. B. Smith... 633,395
Barrel shield, W. A. Frasier... 633,443
Basket making machine, Durham & Devine... 633,342
Bath. See Electrotherapeutic bath.
Bearings, guide frame for rolls in roller, Lockwood & Tellefsen... 633,553
Bed, invalid, G. Huntington... 633,264
Belt, game, L. C. Hoffman... 633,550
Berry grader and cleaner, W. S. Middlebrook... 633,527
Bicycle brake, J. Jamieson... 633,266
Bicycle chain adjustment, A. T. Harris... 633,195
Bicycle, chainless, A. H. T. Hansen... 633,451
Bicycle driving mechanism, W. H. Abercrombie... 633,409
Bicycle frame, P. F. Duffy... 633,127
Bicycle friction gear, T. F. Feeny... 633,130
Bicycle gearing, E. A. Oakman... 633,149
Bicycle hub and bearing, W. N. Whitely... 633,442
Bicycle package carrier, W. H. Marley... 633,386
Bicycle ratchet gear, F. E. B. Beaumont... 633,417
Bicycle saddle, pneumatic, J. J. Monahan... 633,142
Bicycle seat, J. R. Knapp... 633,322
Bicycle spring frame, A. J. Cuming... 633,121
Bicycle toe clip, E. A. Thiem (reissue)... 11,774
Bin. See Hop bin.
Blackboards or slates, writing surface for, W. H. Keeran... 633,551
Blacking chair, shoe, Burns & Minnick... 633,422
Blind, window, P. A. Lathem... 633,521
Blow tester, coin controlled, J. T. Melson... 633,464
Boiler furnace, C. W. Baird... 633,414
Book, I. W. Allen... 633,109
Book cover protector, E. T. Covell... 633,375
Book receptacle, coin actuated, C. W. Craven... 633,308
Book, reversible day, A. O. Hebert... 633,514
Bottle or jar stopper, F. McCarty... 633,468
Bottle stopper, F. G. Stuart... 633,169
Box. See File box. Spool box.
Box and fastening therefor, C. M. Carnahan... 633,356
Box fastener, I. H. Moore... 633,269
Box fastener, E. T. Pugh... 633,327
Box lid holder, J. R. Johnson... 633,200
Bracket. See Shade or curtain bracket.
Brake. See Back pedaling brake. Bicycle brake. Grip brake. Vehicle brake. Wagon brake.
Brake actuating device, A. Cholodkowsky... 633,228
Buckle, D. G. Hurd... 633,137
Buggy or carriage shoulder rest, J. C. Byxbe... 633,305
Bung, beer barrel, W. Kirchhoff... 633,519
Burglar alarm, Spencer & Pethick... 633,396
Burial apparatus clasp, J. D. Moore... 633,208
Burner. See Gas burner. Incandescent burner.
Cabinet, F. A. Horle... 633,318
Caisson and sinking same, W. D. H. Washington 633,298
Calendar for pencil cases, walking sticks, etc., perpetual date, J. T. Draper... 633,435
Calendar, perpetual, J. L. Knight... 633,520
Cams, pulleys, etc., frictional self tightening fastening for, L. T. Sicka... 633,163
Can. See Oil storage can. Sheet metal can.
Cap spindle, Whitaker & Chadwick... 633,302
Car and portable turntable, G. A. & R. F. Dunn.. 633,225
Car coupling, B. J. Johnson... 633,517
Car fender, G. Hipwood... 633,361
Car floor frame, railway, J. S. Francis... 633,577
Car heating system, W. Kinsey... 633,140
Car, railway, C. M. Mileham... 633,205
Car strap, adjustable, H. Murray... 633,363
Cars, device for feeding current to electrically driven, C. F. P. Stendebach... 633,165
Cars, means for transmitting power from axles to bodies of, L. T. Mann... 633,385
Carbureter, E. R. Inman... 633,319, 633,320
Carbureter, Lewis & Bailey... 633,287
Carding engines, means for securing card clothing to cylinders of, J. Dodd... 633,358
Carrier. See Luggage carrier. Straw carrier.
Cartridge packing apparatus, G. H. Beatty... 633,113
Carts, spring board seat for dumping, W. N. Houghtaling... 633,381
Casting apparatus, Patterson & Acklin... 633,151
Casting apparatus, metal, Acklin & Patterson... 633,179
Casting apparatus, metal, W. E. May... 633,326

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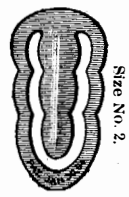

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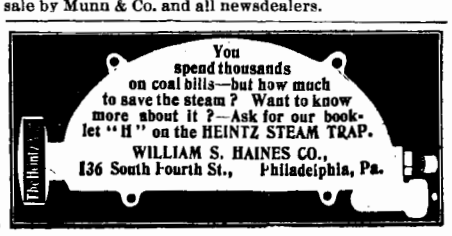
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Chain inclosure, M. G. Read... 633,534
Chair. See Blacking chair. Rocking chair.
Chlorates by electrolysis, manufacturing, T. Parker... 633,272
Churn and butter worker, combined, W. J. Gould... 633,379
Cigar pocket, H. E. Shedd... 633,394
Cigar wrapper cutting machine, P. E. Shirk... 633,162
Clasp. See Burial apparatus clasp.
Clay screener, E. B. & H. A. Rader... 633,486
Clevis, W. L. Bogle... 633,334
Clock, G. W. Adams... 632,257
Cloth cutter, M. D. Kitchen... 633,321
Cloth, pressing, Nussey & Leachman... 633,388
Cloth steamer, D. Gessner... 633,238
Coal unloading and distributing apparatus for use in ballast burning, Z. G. Simmons, Jr., et al... 633,348
Coin controlled apparatus, F. R. Goode... 633,240
Comb. See Hair drying comb.
Concentrating table, U. S. James... 633,265
Concentrator, dry, F. W. Wood... 633,254
Concrete, making, Hains & Weaver... 633,312
Concrete making apparatus, Hains & Weaver... 633,313
Confectionery with chocolate, machine for covering, Forcke & Frings... 633,186
Conveyer, bucket, C. A. Case... 633,118
Cooler. See Milk cooler.
Corn husker, J. J. McDonald... 633,211
Corn husker, H. N. F. Sholl... 633,220
Cot, folding, J. H. Martindale... 633,525
Cotton distributer, G. Ogden... 633,479
Coupling. See Car coupling. Hame and trace coupling. Pipe coupling. Pipe, tube, or casing coupling. Thill coupling.
Crate, F. B. Baugh... 633,279
Cream separator, A. E. Dulmage... 633,437
Crib attachment, A. M. Bartlett... 633,112
Crib safety guard, child's, M. R. Bacon... 633,353
Crystalline substances, process of and apparatus for refining or crystallizing soluble, C. W. Miles... 633,206
Cultivator, sugar beet, Jensen & Rowe... 633,267
Cultivator teeth, adjustable clamp for, W. L. Reall... 633,333
Cultivator, wheeled, A. V. Ryder... 633,160
Cutter. See Cloth cutter. Gage cutter. Ice cutter. Washer cutter.
Cutting and tenoning stock, machine for, C. H. Ellingwood... 633,185
Cycle propelling mechanism, Maynard & Frederick... 633,204
Dental aluminum plates, method of and apparatus for casting, W. Streetman... 633,222
Dental cuspidor, G. P. Davis... 633,125
Desk, hotel register, L. J. Reichel... 633,156
Die press, C. Seybold... 633,205
Die press feeding mechanism, E. Tyden... 633,170
Disinfector, automatic, J. W. Schell... 633,390
Display box cover, S. J. Lynn... 633,522
Ditching machine, T. Thomas... 633,402
Door lock, sliding, A. Newell... 633,291
Door securer, O. Kure... 633,461
Door structure, sliding, A. Newell... 633,290
Downdraught furnace, O. D. Orvis... 633,271
Draught appliance, G. N. Farnsworth... 633,440
Drawers supporter, G. L. Smith... 633,535
Drier. See Grain drier. Mechanical drier.
Drying kiln, F. D. Cummer... 633,122
Drying rack, self adjusting, J. H. Beaulieu... 633,416
Drill. See Grain drill.
Drilling machine, automatic, A. D. Groom... 633,512
Drum attachment, bass, C. E. Reed... 633,488
Dusting machine, R. F. Emmerich... 633,359
Dyeing, Erban & Specht... 633,438
Dyes, making, L. P. Marchlewski et al... 633,245
Egg separator, J. A. Burns... 633,423
Eggs for shipment, packing, C. E. La Fleur... 633,384
Electric motor and pump head, combined, Northam & Nolan... 633,478
Electric switch, centrifugal, R. L. Hunter... 633,516
Electric wires, adjustable crossover for, J. E. Blakesley... 633,182
Electrodes for secondary or storage batteries, forming, H. Rathier... 633,249
Electromedical apparatus, W. P. Sutton... 633,223
Electrotherapeutic bath, H. Stanger... 633,164
Elevator, N. Poulson... 633,215
Embossing machine gage, H. S. Maidhof... 633,362
Engine. See Gas engine. Gas and steam engine. Rotary engine. Rotary steam engine. Steam and gas engine.
Engine indicator, steam, P. G. Poole... 633,532
Engine vaporizer, gas, C. C. Riotte... 633,274
Engines, means for electric ignition for vapor, C. C. Riotte... 633,275
Entries, device for assisting in transferring, T. B. Paschall... 633,481
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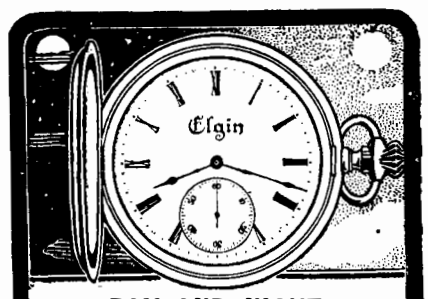
Igniting device, automatic, C. F. P. Stendebach... 633,167

(Continued on page 222)



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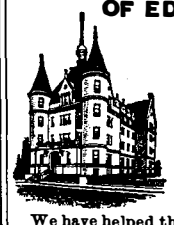

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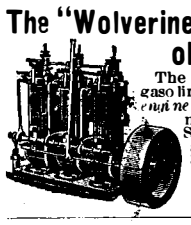

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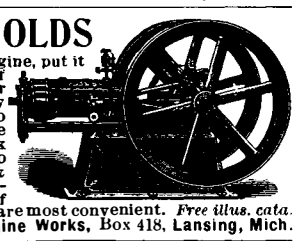

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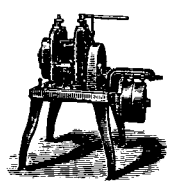

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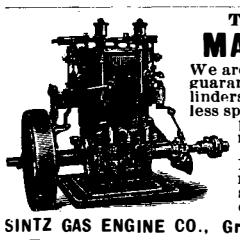

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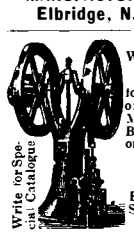

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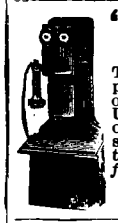

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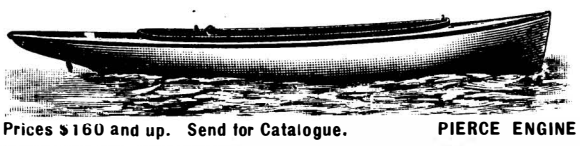

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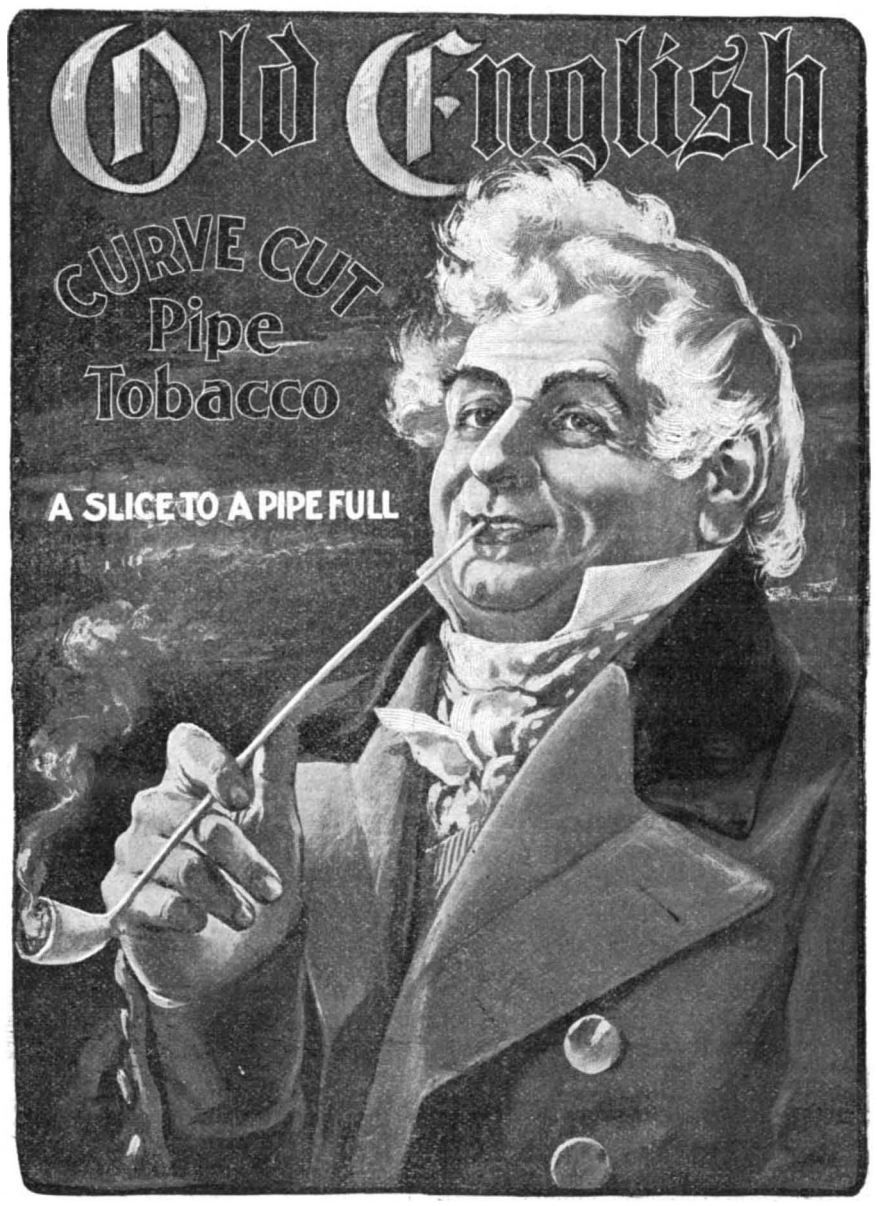

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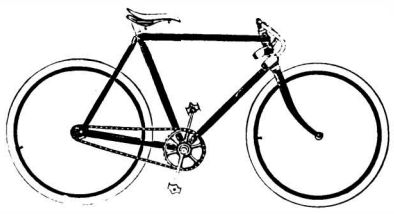

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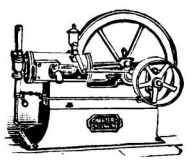

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